Biofuel Evaluation for Technological Tanzanian Efficiency using Renewables – integrated Strategies (Better-iS)

"Strategies to Use Biofuel Value Chain Potential In Sub-Saharan Africa to Respond To Global Change"

(Second Workshop)

Held at Millennium Hotel, Bagamoyo
7 – 8 December 2010

Leibniz Centre for Agricultural Landscape Research e.V.

Environmental Economics and World Trade

The International Food Policy Research Institute

World Agroforestry Centre

Wuppertal Institute for Climate, Environment and Energy

Sokoine University of Agriculture (SUA)

Ministry of Agriculture, Food Security and Cooperatives

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List of Abbreviations

CBO	-	Community Based Organization
ESP	-	Energy Services Platform
FELISA	-	Farming for Energy for better Livelihoods in Southern Africa
GHG	-	Greenhouse Gases
GoT	-	Government of Tanzania
GTZ	-	German Technical Cooperation
Ha	-	Hectares
ICRAF	-	World Agroforestry Centre
IFPRI	-	International Food Policy Research Institute
IUW	-	Institute for Environmental Economics and World Trade
JPTL	-	Jatropha Products Tanzania Limited
KAKUTE	-	Kampuni ya Kusambaza Teknolojia
Kg	-	Kilograms
Lts	-	Litres
M	-	Metre
MAFSC	-	Ministry of Agriculture, Food Security and Cooperatives
MEM	-	Ministry of Energy and Minerals
Mj	-	Mega joules
MNRT	-	Ministry of Natural Resources and Tourism
NBTF	-	National Biofuels Task Force
NGO	-	Non-governmental Organization
NSGRP	-	National Strategy for Growth and Reduction of Poverty
PFM	-	Participatory Forest Management
Pj	-	Penta joules
REDD	-	Reduce Emissions from Deforestation and Forest Degradation
SUA	-	Sokoine University of Agriculture
TaTEDO	-	Tanzania Traditional Energy Development and Environment Organization
Tshs.	-	Tanzanian Shillings
WI	-	Wuppertal Institute
ZALF	-	Leibniz Centre for Agricultural Landscape Research

1. Introduction and Background

This a report of the second annual workshop held from 7th to 8th, December 2010 at Millennium Hotel, Bagamoyo on the project "**Biofuel Evaluation for Technological Tanzanian Efficiency using Renewables – integrated Strategies (Better-iS)**"

The project Better-iS has been implemented in Tanzania since July 2009. The project seeks for strategies to use biofuel value chains in Sub-Saharan Africa to respond to global change. It is a three-year project funded by BMZ through GTZ, the project consortium include World Agroforestry Centre (ICRAF), Leibniz Centre for Agricultural Landscape Research (ZALF), International Food Policy Research Institute (IFPRI), Wuppertal Institute (WI), Institute for Environmental Economics and World Trade (IUW) at the University of Hannover, Sokoine University of Agriculture (SUA) and the Ministry of Agriculture and Food and Cooperatives (MAFC).

Global demand for biofuels is increasing at an alarming rate partly due to rising oil prices. Biofuels have also been seen as an alternative to fossil fuels with their promotion being seen as part of a strategy to combat the effects of climate change. Many African countries have huge potential to produce biofuels due to the availability of land, labour, and favorable climatic conditions.

In Tanzania, there are two main schemes of biofuels production. First, the large-scale devoted production driven by foreign companies. Second, a smaller-scale production of plant oil, mainly from Jatropha involving activities of small scale farmers, CBOs, NGOs and local companies focus on rural development. The trend shows that foreign and local investors are increasingly aiming at investing in the cultivation of crops for biofuels production. This has some serious environmental, social and economical concerns (e.g. effects on food production, displacement of local communities, forest degradation, people's livelihood, land appropriation, etc).

Therefore, Better-iS responds to the global demand for biofuels as it is expected to develop information tools which will assist regional organizations, policy makers, local authorities and farmers with feasible strategies to benefit from biomass production potential in the context of increased global energy demand and climate change challenges.

2.0 Workshop Outline

The workshop programme was designed to be inclusive and participatory. In each session invoked a different general theme to be reviewed, and involved a different project team member to make a presentation on the topic. In order to enable all participants to follow the workshops contents, all presentations and discussions were conducted simultaneously in both English and Swahili. Through these presentations were derived questions for further discussion, and break-out groups

were formed to debate these in detail. Finally, the groups reported on the results of their discussions to the entire forum. Detailed workshop programme is attached as Annex I.

2.1 Day One: December 7, 2010

2.1.1 Welcoming remarks & workshop objective

The workshop was opened by Dr. Aichi Kitalyi , Country Representative for the World Agroforestry Centre (ICRAF). Dr Kitalyi introduced herself and thanked all participants for coming to the workshop. She emphasized the importance of active participation during the workshop because biofuels is an interesting subject to most of the participants and their two-day discussions will contribute to sustainable biofuels development in Tanzania.

Also, Dr. Kitalyi highlighted workshop objectives which remain to share experiences and knowledge, and contribute to the development of sustainable biofuels industry in Tanzania and beyond. She further added that the workshop is a sequence of three intended events aiming at bringing together relevant stakeholders to share experience and knowledge with the focus of contributing to the ongoing initiatives of developing a sustainable biofuel industry in Tanzania. The first workshop was held in Morogoro in February 2010. The final workshop will be held in October 2011.

Dr. Kitalyi presented slight changes to the programme to accommodate delayed arrival of Dr. Stefan Sieber and Ms. Esther Mfugale the MEM representatives who are to give us a briefing on the consortium and the key note address later in the day (Annex 1).

2.1.2 Self introduction and expectations

All participants introduced themselves (Annex 2) in turn and each participant outlined her/his expectations. Participants represented the following categories:

- Biofuel producers (small scale farmers),
- Policy makers,
- Researchers,
- Development partners,
- Non-governmental Organizations (NGOs),
- Academicians,
- Media/press people,
- Students, and

- Private sector

Participant's expectations shown in Annex 3 targeted four areas including:

- Knowledge and education,
- Community participation and livelihood
- Research and
- Policies and strategies

2.1.3 Presentations

2.1.3.1 Better - iS 1st field survey in Tandai village in Morogoro

Day, Dr.Götz Uckert of Leibniz Centre for Agricultural Landscape Research (ZALF - Germany) briefly presented an overview of Better-iS survey in Morogoro.

He highlighted that the genesis of the project was the situation of high oil prices in the world market due to raising demand which attracted more investments on biofuels worldwide. Meanwhile, global climate change calls for the use of environmentally friendly renewable energy resources; biofuels seems to be one of the solutions to combat the effects of climate change. The project Better-iS is after biofuels pro-poor approaches for rural development in Tanzania.

Also, he pointed out that majority of Tanzanians depend on woodfuels (firewood & charcoal) for cooking and heating. Given the growing demand for woodfuels/biofuels, the project conducted a survey in the village of Tandai/ Kilole ward in Morogoro region to :

- explore possibilities of promoting sustainable woodfuels production and consumption,
- assess combination potential of biofuel production and coupled electricity generation for the rural people. Key aspects of the assessment were whole value chain of biofuels, small scale farming – increasing yield and marketing, large scale farming - production efficiency and involvement of small scale farmers.

The speaker pointed out that more than 300 farmers were interviewed in Morogoro, representing approximately a third of the overall population! The second survey will cover selected villages in Laela/Rukwa region, Mpanda/Rukwa region as well as Kigoma and will target small scale Jatropha and Palmoil producers .

He finally mentioned that detailed survey results will be presented in the coming sessions.

2.1.3.2 Questions and Answers

Participants posed a number of questions to the presenter, who provided answers and clarifications. These questions and responses include:

Question: *(a)* Based on the statement that ''land is a limiting factor''– what are the challenges experienced so far? (b) The current situation shows that Biofuels contribution to the energy consumption is very minimal. Is this an incentive for people to give away their land for biofuels production?

Answer: (a) Mode of production will determine land requirement for biofuels production. Sustainable biofuels production can contribute to nature conservation. (b) It should be clear that biofuels cannot meet all the energy needs. In many cases, small part of biofuels crops are used for oil production; it is important to consider residues and other forms of renewable energy to meet the energy demand. More information on the use of residues for energy production will be presented in the coming sessions.

Question: How can the results be interpreted to small-scale farmers?

Answer: Interpreting results to farmers is equally important. Final field results based on the survey conducted in Morogoro will be presented in the next sessions.

Question: Did the research look at urban areas where there are abundant solid wastes/municipal wastes?

Answer: Separating biodegradable and degradable materials is difficult and costly. It has been tried in other countries but failed due to cost implications. Some of the solid wastes might be used to produce briquettes.

Comment: Population is increasing while resources are diminishing. Key issues to focus are efficient production and consumption. An example of improved productivity in West Africa was cited where productivity of cassava is almost 4 times compared to Tanzania.

Comment: The National Strategy for Growth and Reduction of Poverty (NSGRP/MKUKUTA, 2005-2010) targets on energy and poverty have not been reached. For example:

- Number of poor has increased by 1.5 million people,
- Biomass energy contribution to the total energy consumption has increased to over 98%. The target was to reduce biomass energy dependence from 90% to 80%,
- Declining of forest covers (from 40 million to 35 million ha).

Biomass which accounts for over 98% is not a priority within the GoT. The government invest a lot of resources in electrification projects; however only 12 % of Tanzanians have access to electricity and it is only 2% of the rural people. It has reached a time where biomass energy policy and strategy are needed.

2.1.4 Panel Discussion

Panel discussion was meant to create a more active environment and improve participation in the subsequent discussions during the entire period of the workshop. A topic to guide panel discussion was ''**Biofuels development in Africa: where is the small-scale farmer?''**

The session was moderated by Prof. George Jambiya who is a Senior Lecturer at the University of Dar es Salaam. The six panelists debated on the selected topic. These were drawn from public and private institutions such as central government, NGOs, biofuel companies, private businesses, and public universities.

The moderator and the panelists.

The moderator highlighted some of the key issues related to the theme. He pointed out that the small-scale farmer is an important stakeholder in biofuels development. There are good experiences across Africa which revealed that small scale farmers can contribute to sustainable development.

Prof Jambiya pointed out that biofuels have been there for ages, market driven brought up biofuels in recent years with ambitious targets to reduce fossil fuel dependence and poverty reduction; unfortunately these targets have not been achieved. He added that a small scale farmer can own the land but not necessarily he/she can benefit from that land. There is a danger if biofuels is handled wrongly, small scale farmers won't have access to land any longer and may reject biofuel investment opportunities.

After highlights from the moderator, panelists contributed to the topic as follows:

Dr. Damas Philipo, a lecturer at Sokoine University of Agriculture – Department of Agriculture Economics and Agribusiness. His contribution to the topic was centred at examining the biofuels industry in Tanzania with specific emphasis on the challenges facing small-scale farmers in the face of the current fuel crisis and the ever increasing pressure to decrease the emission of greenhouse gases (GHG) which are causing global warming and the resultant increase in the world demand for biofuels.

He begun by pointing out that there are several solutions which have been suggested to tackle the twin problems of fuel crisis and global warming. One of the suggested solutions is the production and use of liquid biofuels. The production of biofuels requires feedstocks such as sugarcane, maize, cassava, oil palm and Jatropha. This inevitably erases the line dividing the food and energy markets. Whilst the merger of the energy and food markets provides new opportunities to small-scale farmers, there are new challenges that farmers would have to overcome in order to benefit from the increasing demand for biofuels.

Dr Damas added that global demand for climate-friendly transport fuels is driving vast commercial biofuels projects in countries such as Tanzania. This has amongst others led to fears of land grabbing and hence driving small-scale farmers out of the land they have relied for their livelihoods for many years. Threats like this call for a production model that will ensure that large scale biofuels production does not compromise the returns to investment for large scale investors and the ability of the poor to meet their energy needs and diversify their livelihoods without compromising food security. This can be done by ensuring that small-scale farmers participate fully in the biofuels supply chain. One way through which they can be involved is supplying feedstocks for producing biofuels. This, amongst others, has the benefit of reducing operational as well as reputational risks. Since it will not be possible to involve all displaced farmers in the biofuels supply chain it is important to ensure that they are compensated fairly in order to make sure that the disruption of their livelihoods is minimized.

According to the 1st Panelist, increase in investments in biofuels production in the country is also likely to put an upward pressure on food prices. This is mainly due to the shifting of factors of production such as land and labour from growing food crops to production of feedstocks for ethanol and/or biodiesel production. The increase in food prices that is likely to be associated with biofuels production will have negative impacts on the livelihoods of small-scale farmers in the country. This is mainly because most of the small-scale farmers in the country are net food buyers. Consequently, the increase in food prices will offset the benefits associated with their involvement in the biofuels supply chain.

Finally, he concluded that the impact of investments in biofuels production on food prices and hence the livelihoods of small-scale farmers in the country can be reduced by making sure that certain areas of the country are reserved for food production. Moreover, small-scale farmers should be well informed of the challenge ahead and the best way to overcome it.

Mr. Bariki Kaale, energy and environmental specialist for the United Nations Development Programme (UNDP) was the 2nd panelist. He started by underlining

that UNDP supports a number of energy projects including biofuels as a way of promoting sustainable development.

He said that biofuels are new initiative raising a lot of hope at global, national and local levels; however, we need to share experiences to prove these hopes. UNDP is willing to share experiences across the global.

According to Mr. Kaale, some of the potential crops for biofuels production such as sugarcane, cassava and palm oil have been well researched; but Jatropha which seems to be a potential crop for biodiesel production, is only in the focus of research since half a decade in Tanzania – in most cases we depend on research results from India.

As a way forward, Mr. Kaale pointed out key points which need attention of various stakeholders.

- Research on energy crops should focus on getting high productivity,
- Small scale farmers should be trained on how to intercrop energy crops with other crops to realized multiple benefits,
- Linking agroforestry with energy crops; however research is required to determine species, geographical areas, etc.
- Environmental Impacts Assessment is important for large scale production of biofuels. Keys issues to focus should include conservation of water catchment, biodiversity, human rights, people displacement, etc.
- Create awareness of farmers to understand prevailing opportunities of biofuels,
- Information sharing across the stakeholders,
- Political instruments such as policies, development strategies, etc. The Government of Tanzania has approved biofuels investment guidelines - what is the next step?

Mr. Estomih Sawe, the Executive Director of the Tanzania Traditional Energy Development and Environment Organization (TaTEDO) was the 3rd panelist. He begun with highlighting that TaTEDO is aiming at helping the majority of Tanzanians to gain access to modern efficient energy technologies and services – those who depend on biomass for cooking and don't have access to electricity. He added that TaTEDO works with different stakeholders including NGOs, GoT, CBO and private companies to promote biofuels in the following forms – liquid, solid and gaseous.

According to Mr. Sawe, key drivers of liquid biofuels development in Africa are:

- Increasing awareness of energy security as crucial measure for sustainable development,
- Business opportunities for investors,

- Rural development and improved livelihoods for the rural population in African countries,
- Increased access to modern efficient energy services and income generation opportunities,
- Potential transition from traditional biofuels to modern biofuels,
- Sustainable large scale production of biofuels and food through communities, smallholder farmers, cooperative and local enterprises,
- Modernization of agriculture practices and sustainable soil and land management to exploit complementarities of food and biofuels production,
- Potential for use of energy crops and agriculture residues for electricity production, fuels and mechanical power production,
- Reduced dependence on imported expensive fossil fuels,
- Contributing to the achievement of the MDGs and poverty reduction strategies.

He added that more than 70 percent of the population in Sub-Saharan Africa depends on agriculture for their livelihoods, mostly through small scale farming in rural areas. The economies and population welfare of most African countries depend on performance of smallholder farmers and the agricultural sector in particular. Poverty reduction in Africa will significantly depend on the vibrant agriculture sector that provides income, employment and affordable staple food and fuels. Most extension personnel in Africa already have adequate experience in dealing with small scale farmers with limited success in some areas. It is important to draw lessons from the Asian-green revolution which was government driven with the goal to self-sufficiency in food grains, the green revolution was market, local private sector and small scale farmers based. The African continent could learn from Asia to assist it agriculture development efforts with priority on self-sufficiency in food and fuels, this goals should be driven by the already existing threats of food shortages coupled with increasing food and fuel prices.

Mr. Sawe shared TaTEDOs experience in promoting biofuels in Tanzania by mentioning that the organisation has successfully been working closely with several stakeholders and development partners in promoting the cultivation and utilization of Jatropha plant through small scale farmers. Jataropha oil is alternative fuel in powering diesel engines for various productive and consumptive uses. TaTEDO has initiated projects for rural electrification using Energy Services Platform (ESP). The ESP consists of engine, alternator for electricity generation, milling machine, oil press and battery charging. ESPs have been installed in Engaruka, Selela villages in Monduli district; Leguruki in Meru district; Laela in Sumbawanga district; and at her centre in Dar es Salaam. Since the engine can use both diesel and Jatropha oil, most of the time the engines runs on straight vegetable oils to power engine for electricity generation and other components for provision of modern energy services. In all these villages straight Jatropha oil is pressed from seeds bought from the small-scale farmers.

He further added that electricity is distributed to the villagers from the ESP centre through mini-grids constructed in the villages using locally available materials and man power. Villagers have been using ESP electricity as alternative sources of energy for lights, radios, charging phones and batteries. These are the direct benefits to the villagers who have been connected to ESP powered by Jatropha oil. Since the plant itself is draught resistant, it can grow in marginalized and unfertile soil. A number of efforts have been made at local level such as supporting small-scale farmers and other stakeholders to engage and grow Jatropha in multitude, since straight vegetable oil holds great promises for the rural communities.

The speaker urged for African countries to take urgent action in formulating and implementing appropriate policies and regulation. Criteria and issues for consideration in developing biofuels production and use policies should include:

- Sustainability criteria for local and national biofuels development,
- Pro-poor policies to protect small-scale producers from larger scale multinational investors,
- Fair trade practices at all levels, establish local and national biofuels markets,
- Integration of biofuels development with other development initiatives aiming at self-sufficiency in food and fuels at the national and local levels,
- Give priority to small-scale farmers and local markets for rural electrification, water pumping, transport and agriculture fuels,
- Ensure rural livelihoods improvement, national economic growth through the development of biofuels processing industry at different levels.

Mr Sawe concluded that if appropriate policies and regulations are not in place, implementing liquid biofuels production through large scale farmers pose risk for Africa through land and water degradation, loss of biodiversity, exploitation, exclusion of small-scale farmers and increased food insecurity. Over the years, the small-scale farmers in Africa have been abandoned or neglected; as such they lack adequate land, capital, technology (extension services), markets for inputs and products. As such the liquid biofuels development policies should be pro-small-scale farmers, governments should put more faith in small-scale farmers' ability to improve productivity and help them towards large scale production of food and fuels in Africa.

Dr. Hamimu Hongo, the Managing Director of Farming for Energy for better Livelihoods in Southern Africa (FELISA). He started by stating that FELISA is targeting to produce biodiesel from palm oil for power generation and other bioenergy uses.

Contributing to the topic, Dr Hongo gave a quick answer that ''small-scale farmers are no where to be seen''. This is a mistake, resulting out of the fact that the Tanzanian government adopted the idea of biofuels without getting prepared. The government had no policies in place neither the guidelines on biofuels. So grabbing

of land by investors from outside the country was a bitter pill to swallow to small-scale farmers.

In concluding, Dr. Hongo put forward the following key issues:

- There is great potential of biofuels development in Africa and in particular in Tanzania,
- Small scale farmers should be taken on board right from biofuels planning to execution without disturbing their farming systems,
- If we can start with energy crops which are already familiar to the farmers in areas of biofuels production will be more easier than using new crops which both the investors and farmers have very little knowledge on it,
- Investors and scientists should drop out their wrong notion that farmers can not plan for their life. If given a room for them to participate from planning to processing, farmers can perform well,
- Biofuels are beneficial to small-scale farmers provided the government will prepare a good policy and guidelines and involve or treat small-scale farmers as an important part in the production systems of biofuels. Small –scale farmers may be a great pillar in biofuels production if they are well backed.

Mr. Emilian Philip, a Research and Planning Officer at Jatropha Products Limited (JPTL). He begun by pointing out that wood biomass (fire wood and charcoal) is the major source of energy in Tanzania. Its availability is however acutely diminishing due to high rate of deforestation. The immediate consequence is forcing women in particular to travel long distances in search of favorable tree species. Another critical problem in country is hunger and malnutrition due to persistence drought each year. Low agriculture performance occuring mainly due to drought as well as a lack of sufficient farming capital are other areas of concern in rural regions. High poverty level is a critical and limiting factor in undertaking any meaningful development initiative. Local people cannot afford alternative fossil fuels, at the current exorbitantly sky high prices. Initiatives taken so far to re-address the situation have been constrained by lack of sufficient resources. Tackling energy problems in isolation will therefore not bear meaningful results given multiple problems farmers in the proposed projects face.

Mr. Philip added that new developments in the use of *Jatropha curcas* as an alternative source of energy have raised hope for arresting the fuel shortage in the rural areas. Jatropha has been thriving in most areas as wild plants and purposely grown to mark boundaries (Farms and animal cage enclosures), animal corridors and medicinal uses. Promoting Jatropha as alternative source of energy has been received with mixed feelings. Farmers have been sensitized to grow, extract oil from seeds, use oil produced into special designed lanterns, lamps and local cook stoves. Growing Jatropha had not been in expected pace until the introduction of agricultural components alongside Jatropha (Intercropping, wide spacing 5 -7 m for

people with vast land such as Kiteto district, provision of agricultural seeds and technical knowledge).

He further added that the multiple uses of Jatropha products are another stimulating factor for farmers to engaged in biofuel production, high decomposition rate and good performance of seedcake in farms ideal for organic manure, use as substrate in biogas digesters. The use of Jatropha oil in production of soaps is the preferred production pathway for farmers as they use it for their own use and for selling.

Mr. Philip concluded by saying that small-scale farmers will actively engage in cultivation and processing of biofuels crops only when other priority needs (by products soaps, manure, biogas, insecticides and food security) of their choices are promoted as well. This is because of unreliable markets of seeds and oils and unrewarding prices of their produces. There will be no establishment of new plants if the current market situation is left unchecked; the only immediate solution is inclusion of agriculture components and promotion of other uses besides biodiesel use.

Mrs. Esther Mfugale, a Principal Agricultural Research Officer with Ministry of Agricultural Food Security and Cooperatives. She is currently seconded to the Ministry of Energy and Minerals as Biofuels Project Officer.

She started by saying that the government of Tanzania promote biofuels with ambitious focus to improve energy security (e.g. reducing oil imports and foreign exchange savings), improve peoples' livelihoods and promote rural development. The GoT understand that biofuels is an investment opportunity but there are a lot of challenges that need to be resolved. These include land grabbing, food insecurity, biodiversity losses, etc.

She highlighted some efforts within the GoT to promote biofuels. These are:

- Establishment of National Biofuels Task Force which worked closely with stakeholders to develop the liquid biofuels guidelines which was approved by the GoT in 2009. The guidelines outlines institutional framework for sustainable biofuels production in Tanzania,
- Project to support biofuels policy development. The project is funded by Swedish and Norwegian governments. Key activities of the project are to:
    - review biofuel related policies and legal frameworks,
    - building capacity on biofuels issues at all levels,
    - assess the need to integrate biofuels issues in the existing sector policies,
    - conduct agro-ecological zoning based on the potential feedstocks for biofuels production,
    - work with research institutions – crops and productivity. Research

results will be shared with communities.

Finally, she said the GoT would like to have sustainable biofuels investments and production for the benefits of future generationsand is therefore working on regulatory and legislative instruments to guide biofuel development in the country.

Questions and Answers

At the end of panel discussion, participants posed questions to the panelists. Questions and answers are summarised below.

Question: In some areas it is cheaper to use sunflower oil than Jatropha oil; is this something that can be worked out and adopted?

Answer: Sunflower oil is more expensive than Jatropha oil; however this needs a detailed economic analysis especially on issues related to productivity, species, etc. Also, market for sunflower oil and Jatropha oil depend on the location. It is obvious that Jatropha oil is cheaper than sunflower in the rural areas.

Question: There is no problem with biofuels market- it is there, but why are the small-scale farmers not producing enough biofueles?

Answer: Dynamics in the current system are very complex, maybe more research in the context of small-scale farmers is needed. Reasons for not producing are site specific, e.g. in Mpanda, villagers argue that they don't produce Jatropha because it is dominated by one company, the price is very low, lack of knowledge on Jatropha farming-they need Jatropha experts, land scarcity –especially the poor, they would like to intercrop with Jatropha – to save time, land and labour;

Question: In order to address research aspects, how is research components taken onboard and where are the inter-sectoral linkages with other ministries such as Ministry of Natural Resources and Tourism, Ministry of Food Security and Cooperatives, etc?

Answer: There is Biofuels Technical and Steering Committees which have members from sector ministries such as energy, forest, agriculture, water, etc; and CSOs. All these are coordinated by MEM. The revised Agricultural policy has taken onboard research issues related to biofuels crops.

2.1.5 Session 1: Biofuels production and development – complementing each other?

Mr. Harry Hoffmann, a PhD student at ZALF talked about the Partnership Farming Approach. The approach is under development - not published yet. It is being

developed by combining lessons learnt out of long-time experiences of GTZ gained in optimizing agricultural supply chains. The approach promotes a sustainable agriculture and contributes to improved agricultural knowledge necessary to access international quality markets.

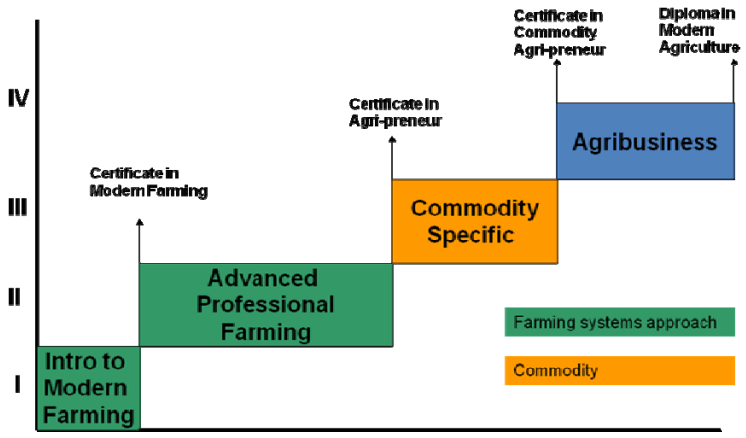
Mr. Hoffmann pointed out characteristics of the Partnership Farming Approach as:

- Buyer offers broad education to a variety of commodities and production systems beyond the contractual relationship,
- Farmers (and laborers) qualify as agricultural professionals acting as self-sufficient decision-makers,
- Financing through contributions by farmers (through course fees), public and private sectors with initial support by donors.

Success implementation of the approach will enable farmers to become self-sufficient decision makers – "agripreneurs":

- Establishment of a long term and trustful business partnership through investments along the supply chain,
- Agricultural education in addition to commodity-specific training,
- Combine small scale production in the field with large scale farming,
- Include agricultural labourers, not just farmers, in the training and educational activities.

He further illustrated the ''Stepwise Approach'' as show in the chart below.



2.1.5.1 Group work and presentations

The presentation on ''Partnership Farming Approach" was followed by group work. Two groups were formed – Group 1 (representing biofuels investors) and Group 2 (representing small-scale farmers). Groups were asked to discuss and make

presentation on the future development of the biofuels in Tanzania (large scale and small scale approaches) with special focus on the ''Partnership Farming Approach"

Group 1 (investors perspective)

The main objective of an investor is to make profit. The group presented the following key issues which need attention while developing biofuels projects.

- Recognize well organized farmers' cooperatives as trading partners,
- Open minded in terms of varieties of potential biofuels crops,
- Positive energy balance- inputs should relates to outputs,
- Labour has minimal impact, can be obtained elsewhere across the country, and
- Land title for big farms focusing annual crops.

Group 2 (small-scale farmer perspective)

Key issues presented by the group were:

- Markets – farmers are not sure of the reliable markets. In addition farmers are very sensitive to the new crops.
- Food security – farmers may concentrate in producing biofuels crops. Due to unreliable markets, this may lead to food insecurity,
- Awareness
    - Lack of awareness may lead to farmers not consider agricultural technologies e.g. intercropping, etc.,
    - Lack of awareness can cause farmers release their land or change use without considering land management rules,
    - Compatibility with other crops- it may lower yields.
- Incentive schemes
    - If farmers are motivated in terms of markets, infrastructures, etc; they can opt to grow biofuels crops,
    - Providing simple processing equipment to be used by farmers to extract biofuels/oil for own consumption,
    - To form small-scale farmers biofuels associations or cooperative.

2.2 Day Two: December 8, 2010

Day two began by a recap of day one. Mr. Francis Songela, a rappotour briefly highlighted what transpired in day one as per workshop programme.

2.2.1 Presentations

2.2.1.1 Introduction of the Better - iS project

Dr. Stefan Sieber, coordinator of Better-iS (Berlin/Germany) was invited to give a presentation about the Better – iS project.

He started by sharing some of the highlights on ongoing meeting on climate change in Cancun, Mexico and its linkage to climate change adaptation and mitigation initiatives in Sub-Saharan Africa. The speaker said that consensus in the Cancun meeting might be impossible due to the fact that world-wide diversity is tremendous, conflicts and differences of interests and enormous transactions costs. He further talked about subsidiary principle and said that it should act at regional level where problems occur; and policies should be targeted accordingly.

He then spoke on the three GTZ supported projects: (i) Biofuel Evaluation for Tanzanian Efficiency using Renewables (Better –iS), (ii) Resilient Agro-Landscapes to Climate Change in Tanzania (ReACCT), and (iii) Strategies for Adapting to Climate Change in Rural Sub-Saharan Africa: Targeting the Most Vulnerable. All these projects target climate change affected regions and rural people, developing climate change adaptation strategies; and climate change mitigation.

He further explained that the above projects target sub-Saharan Africa because they:

- follow efficient subsidiary principle,
- are cost-efficient (as regional level),
- provide tools and new findings,
- are pro-poor oriented,
- let people decide in participative way,
- comply thus regional, national policies,
- build a platform for exchange,
- aim at actual implementation by long-term strategy.

Dr. Sieber also highlighted the two generic drivers of the Better –iS project.: climate change and energy demand. Biofuels have the potential to benefit to rural populations in sub-Saharan Africa through provision of multiple energy services such as heating, cooking and transport. On the other hand there are associated risks

such as increasing food prices and reduced supply, as well as the displacement of vulnerable people from productive land and negative environmental impacts.

Objectives of the Better –iS project are:

- To identify the potential for linking low-productivity farming to small and medium enterprises (SME) to enhance livelihoods through biofuel value chains,
- To provide farmers, regional organizations and local authorities in sub-Saharan Africa with feasible strategies to benefit from biomass production potential and mitigate food insecurity,
- Pathways on biofuels value chains from (1) biomass resources to (2) supply systems, (3) conversion (4) processed end products:
    - Maximizing profit through producing feedstock for external markets,
    - Optimal mix of energy carriers and supply for domestic and industrial users at rural level

He presented the following project outputs and responsible partner institution (s):

- Output 1: [IFPRI] Development of a set of **alternative global scenarios** with implicit climate change projections focusing on energy demand, resulting changes of crop prices, land use, biomass feedstock usage and traditional food production for biomass production

- Output 2: [WI] **Biomass (food, material, energy) production and consumption patterns** (incl. export-/import-structures) in sub-Saharan Africa with detailed focus on Tanzania (using outcome of output 1 and output 3)

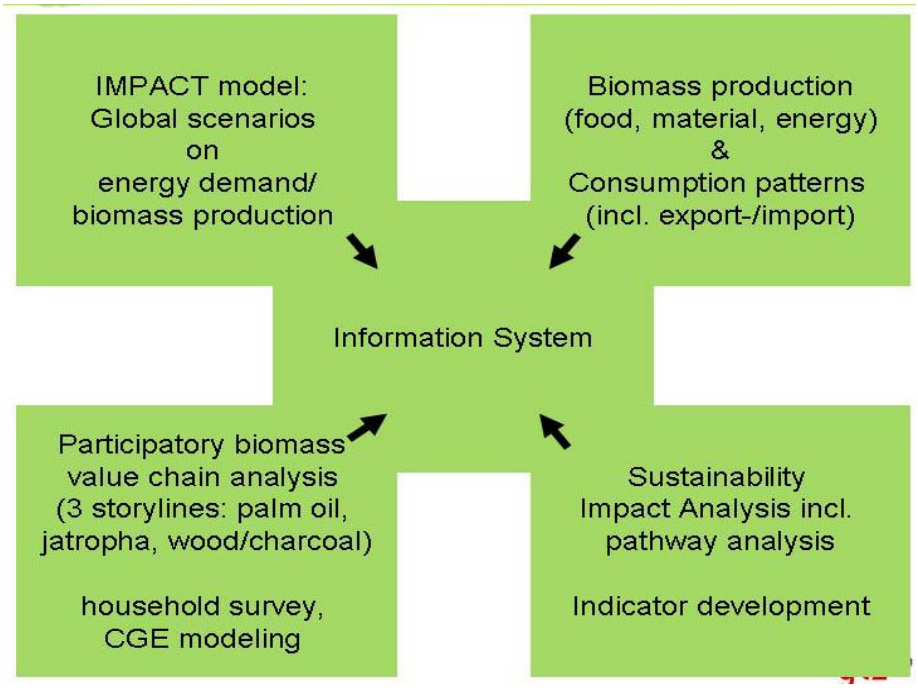
- Output 3: [ICRAF, ZALF, IUW] **Participatory biomass value chain analysis** for small-scale farmers in Tanzania subjected to pathways related to production and socio-economic conditions (e.g., employment, land tenure, human capacities); with special regard to comparing local market and export market with certification option to ensure sustainable use of natural resources.

- Output 4: [ZALF, ICRAF, WI] **Sustainability Impact Analysis** in case study region under developed alternative global energy scenarios with focus on implications for livelihoods, environmental safety, regional economy) including a synthesized framework on costs, benefits and risks of regionalized typologies (pathways) of biomass value chains and implications for food security.

- Output 5: [All] **Information System for Decision Support** in module-structure and theoretical concepts for Capacity Building including training

measures at farm schools, local authorities to benefit small-scale farmers and / avoid negative effects.

In the following, he summarized outputs of Better –iS as shown in the diagram below.



Dr Sieber also shared examples on each output. He talked on the Impact Model being developed by the IFPRI. IFPRI is tasked to:

- provide overall global picture of changes in food and energy markets and how they impact Tanzania; and characterize agricultural growth patterns under alternatives – and implications for food security,
- document and clarify drivers of change underlying storylines that will be used by other teams (socio-economic and environmental factors),
- evaluate agriculture and energy market impacts under cases and implications for trade, and
- help build global-national-village level linkages.

General description of baseline to be considered while developing the Impact Model is summarized in the table below.

	Descriptive features
Population Growth	Annual average growth: • 1.8% over the 2000-2015 period • 1.4% over the 2015-2030 period
Economic Growth	Annual average growth: • 3.6% over the 2000-2015 period • < 4% over the 2015-2030 period
Energy Technologies	Most rural poor rely on crude biomass for household uses (with women/girls bearing collection burden) Urban-dwellers use charcoal/kerosene as alternatives (un-reliable electricity and poor coverage) Most transport use in diesel Limited renewable alternatives
Agricultural Technologies	Relatively low-levels of adoption of irrigation (share of cereal area under irrigation grows from 1.7% →2.4% by 2030) Low levels of fertilizer use, and mostly dominated by smallholder subsistence agricultural production systems

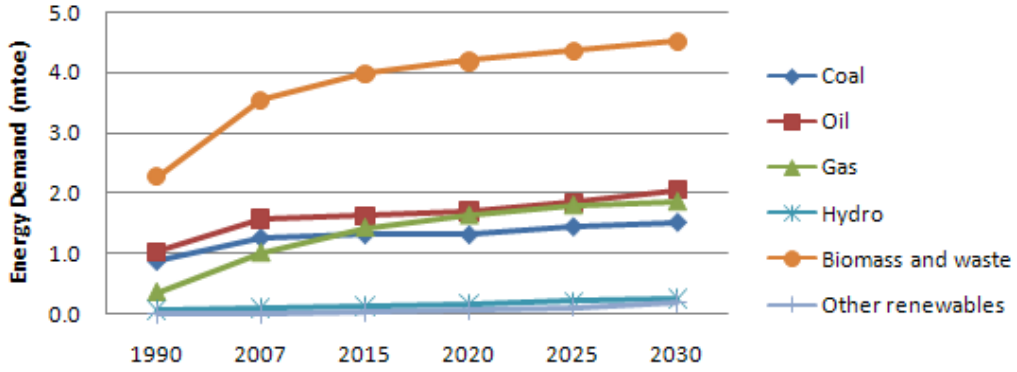
Under the Impact Model, alternative futures for Tanzania were discussed focusing on two alternatives to the reference/baseline:

- **"Security First"** – which is a "Balkanization"-type of scenario that has much less trade (much higher levels of trade protection), slow diffusion of knowledge, less innovation, and slower economic growth. Most of the key socio-economic indicators point in the "negative" direction under this scenario

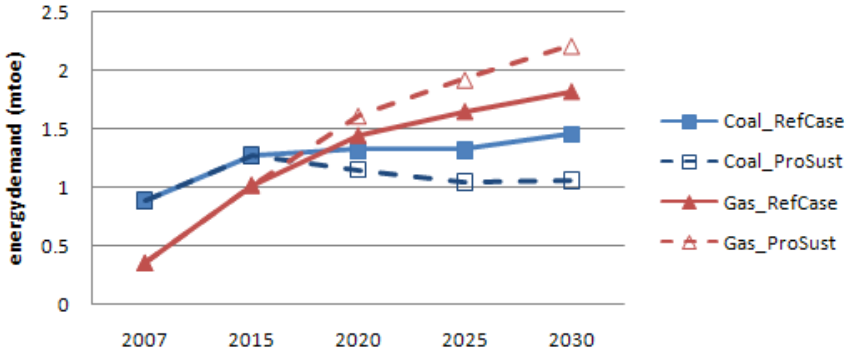
- **"Sustainability First"** – which is where policies promoting environmental protection, more efficient energy usage and technologies, and more emphasis on yield and productivity growth to avoid agricultural area expansion

Figures below illustrate different scenarios.

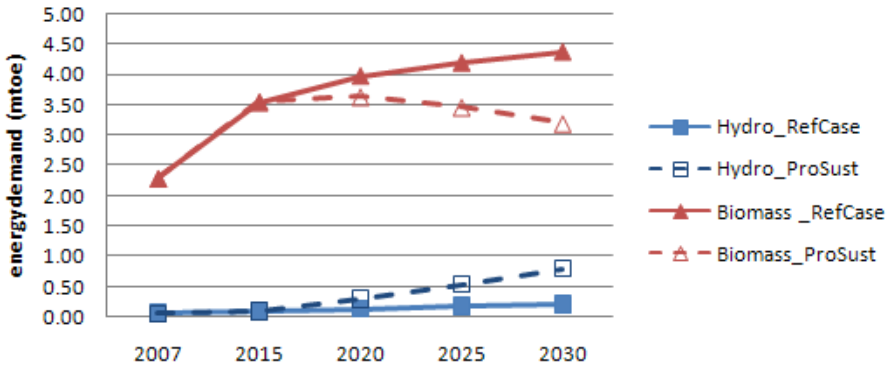
Primary Energy Demand to 2030 for Tanzania *[based on IEA reference projections]*



Primary Energy Demand to 2030 under alternative scenarios *[Move to cleaner fossil-based fuel sources under a 'pro-sustainability' case]*

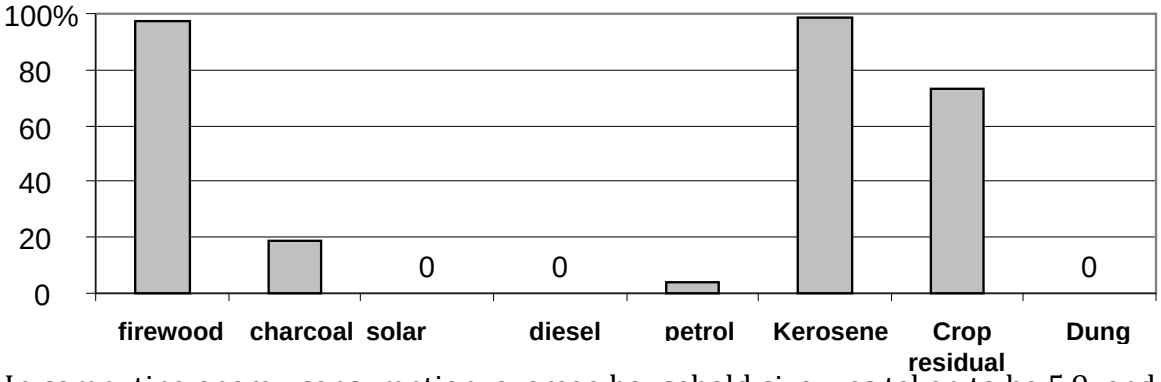


Primary Energy Demand to 2030 under alternative scenarios [*Move away from biomass towards other renewable fuels under 'pro-sustainability' case]*



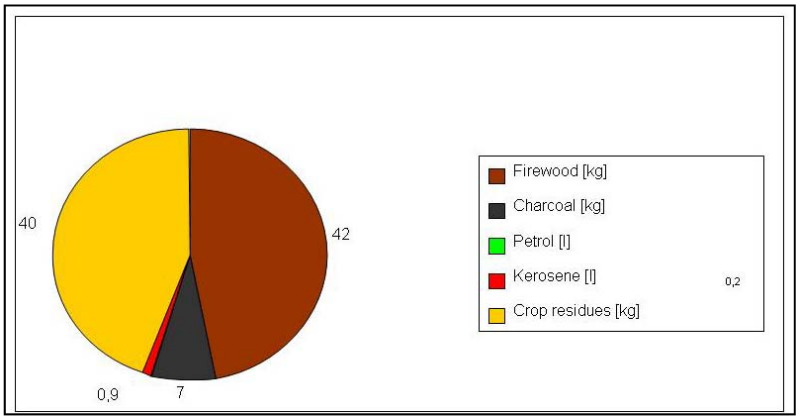
Under output 2, results on consumption patterns for Tandai Village in Morogoro were presented. Preliminary results were derived from a total of 70 households. Each household has an average of 2.7 hectare of land for agriculture.

Firewood and kerosene are the dominant energy sources for cooking and lighting respectively.



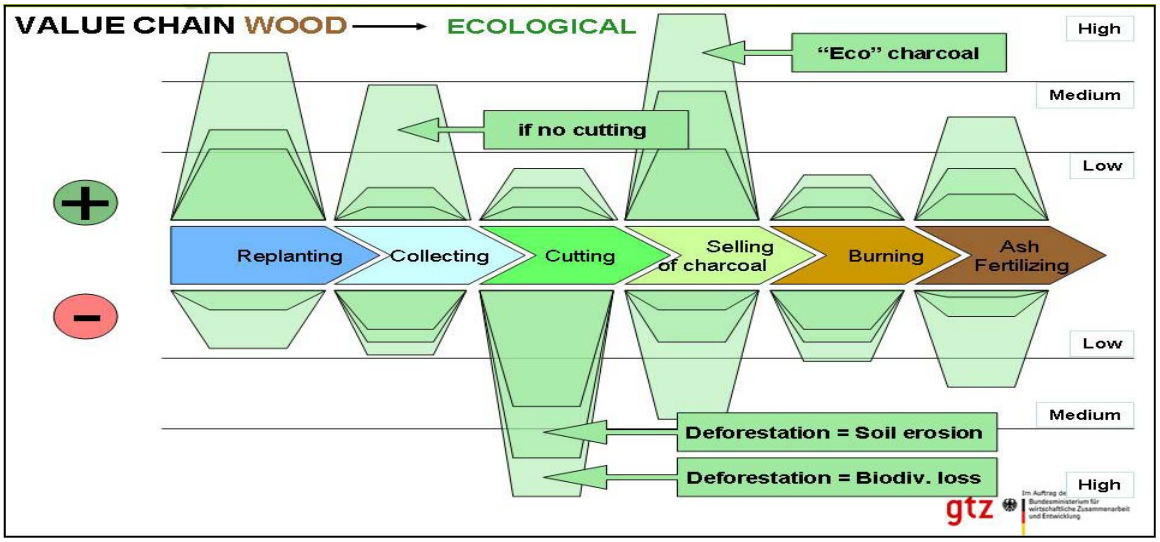
In computing energy consumption, average household size was taken to be 5.9, and the average number of energy sources per household was estimated to be 2.9.

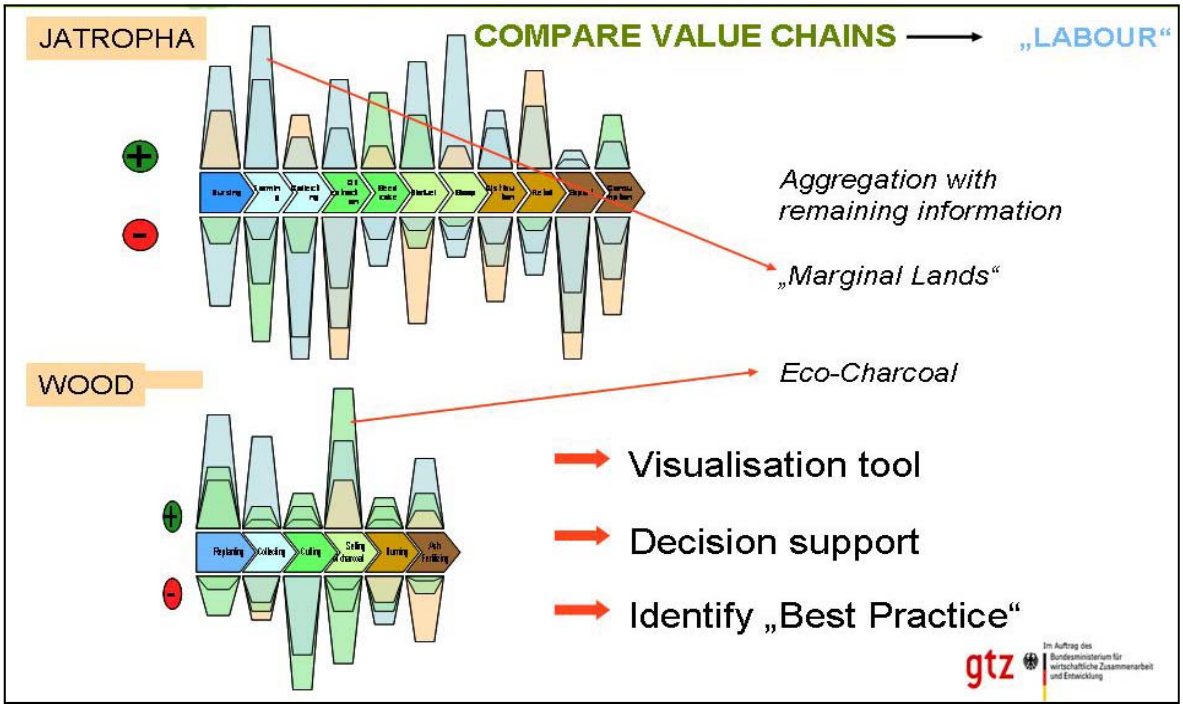
Average consumption of used energy devices per household in kilogram or liter per week is shown in the chart below



Notable environmental changes were also discussed. Forest species especially Uluguru Bush-shrike (‘’ Kulumbizi bird’)’ and Black and White Colobus monkey were assessed. Assessment concludes that population growth and over usage of firewood reserves will contribute to decreasing of montane cloud forests, habitat of Colobus monkey and Kulumbizi bird.

For output 3, value chains analysis for wood and Jatropha were discussed as illustrated in the following exemplarily diagrams.

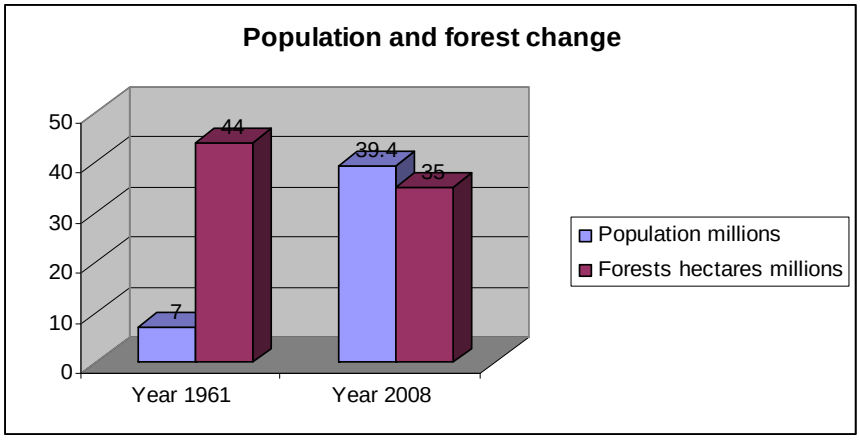


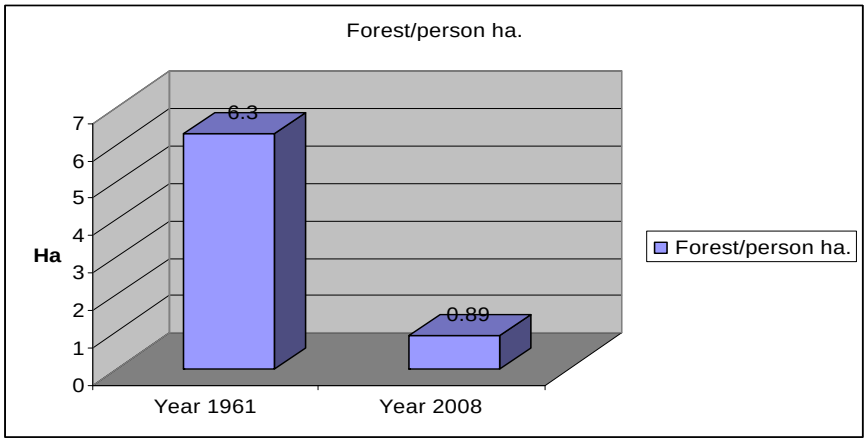


Lastly, the presenter talked about the decision support tool and information System. ScaLA is a cross-project development tool developed with funding from BMVEL, GTZ Sustainet, GTZ Sektorvorhabens "Nachhaltige Ressourcennutzung in der Landwirtschaft'', Better – iS and ReaCCT. The project website www.better-is.com has been created to share lessons and information on the project activities.

Comment: Use of crop residues is definitely due to diminishing biomass supply. In line with this, Mr. Kaale did a 5 – minute presentation on the current and future demand for energy and its linkage to climate change.

He presented some photos and the following charts to justify the situation.





2.2.1.2 Biofuels Development in Tanzania

On behalf of the biofuels project unit at the Ministry of Energy and Minerals, Mrs. Mfugale gave presentation on Government of Tanzania (GoT) initiatives towards biofuels development.

She started by saying that biofuels in the form of liquids, solid or gaseous have proved to be strategic alternative sources of fuel for cooking, lighting, power generation and transportation. It is a new energy source which holds the potential to displace fossil fuels such as diesel, gasoline and kerosene. Liquid biofuels are used in existing vehicles with little or no modification to engines and fueling systems. They provide alternatives to fossil fuels and can be produced sustainably by energy

crop farming, animal husbandry and waste management with energy recovery. Potential energy crops for liquid biofuels production include Jatropha, sugarcane, palm, sunflower, croton, etc

The speaker added that the GoT recognizes potential benefits of liquid biofuels such as:

- Improvement of national energy security/self-sufficiency;
- Diversified energy sources;
- Reduced fuel import bill;
- Establishment of new jobs and income opportunities through bioenergy farms and processing facilities;
- Contribution to environmental conservation and climate change.
- Technology transfer through new bio-energy industries,

She further explained that in recent years, Tanzania has started receiving a number of expressions of interest in investing in biofuels production due to the growing demand of biofuels in the world. Like other African countries, Tanzania has vast land resources and conducive climates; there is no doubt that biofuels have the potential to provide the much-needed energy for industrialization and poverty reduction.

There are number of companies working on biofuels project in Tanzania. These include:

- EcoEnergy Tanzania Ltd (former SEKAB Bioenergy Tanzania Ltd.) – Bagamoyo and Rufiji districts,
- Prokon of Germany growing Jatropha in Mpanda – Rukwa;
- Africa Bioenergy - United States of America growing Croton in Biharamulo
- FELISA growing palm in Kigoma;
- Sun Biofuels Tanzania Ltd Jatropha in Kisarawe district,
- Diligent – a Dutch Company jatropha seed processing in Arusha,
- Bioshape growing Jatropha in Kilwa, unfortunately the company is out of business,
- Other interests - the palm oil production in Handeni by the Environvest Tz Ltd –Seychelles.

She added that most of these initiatives started in the absence of appropriate system to coordinate development of biofuels in Tanzania. A mechanism to ensure a framework for the development of National Biofuels Platform is needed. Therefore, in March 2006 Ministry of Energy and Minerals decided to establish a National Biofuels Task Force (NBTF) to work out the road map for biofuels development and utilization in Tanzania. The Taskforce members were nominated from the relevant institutions following their importance and anticipated contribution in the overall development of Biofuels industry in Tanzania.

Government initiatives towards sustainable biofuels development include:

- Conducted strengths, weaknesses, opportunities and threats analysis on biofuels development in Tanzania. Based on the analysis, priority strategic actions were developed,

- Drafted Liquid Biofuels Guidelines document which was then approved by the cabinet in 2010. The guideline propose institutional framework including biofuels one stop centre to be hosted at the Tanzania Investment Centre (TIC). Establishment of a specific section within the Ministry of Energy and Minerals to deal with biofuels issues. It further proposes to carry out of agro-ecological zoning to determine specific areas for different uses including biofuels investments,

- Preparation of a 2-year Project "Strengthening the policy, legal, regulatory and institutional framework to support the development of a sustainable biofuels industry in Tanzania". Highlights on the project progress include: specific project agreement between Sida/NORAD and MEM have been signed, inception meeting conducted, official launch of the project was conducted on 5th February 2010, policy, legal, regulatory and institutional framework; starting with the review of the existing policies, and preparation of agro-ecological zoning exercise,

- Inclusion of Biofuels in the revised Petroleum Act of 2008. The Act recognizes liquid biofuels by including it in the definition of petroleum products. It gives mandate to the Minister responsible for energy to make regulations to publish blending ratios and standards on liquid biofuels. However, operational /regulatory issues would be dealt with EWURA.

She concluded by defining Biofuels development as cross-cutting issue. It needs support from the full spectrum of stakeholders including Government, private institutions, NGO's and development partners.

2.2.1.3 Questions and answers

Mrs Mfugale's presentation was followed by a number of questions. Questions and answers are summarised as follows:

Question: Agro-ecological zoning- how can this process fit into practical terms and collaborate/work together with the GoT?

Answer: Stakeholder's participation in the process will be given high priority by the GoT. GoT is ready to share information that could be of interest to the stakeholders.

Question: Land availability – increased population is a threat to biofuel development in terms of land availability for these investments – does the GoT see this as a challenge in the near future?

Answer: The GoT does not advertise land availability to encourage investors. This will be solved only if the guidelines will be followed.

Question: Field experiences show that it is not necessary that biofuels will mitigate climate change- how is the GoT prepared on this?

Answer: Scientifically biofuels reduces emissions which have adverse effects on climate change.

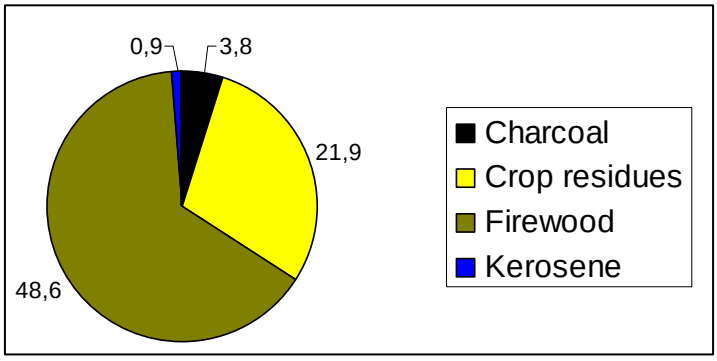
Question: How are the guidelines legally binded?

Answer: Meanwhile these guidelines serve as legal documents supported by the investment and petroleum acts. But they will be enforced by agro-ecological zoning exercises and biofuels policy.

Comment: Land accessibility and conflicting uses of land such as grazing, fruits, etc are often been ignored. Agro-ecological zoning should focus at other land uses and possibility establish ''no – go '' areas such as high biodiversity areas, wetlands, etc.

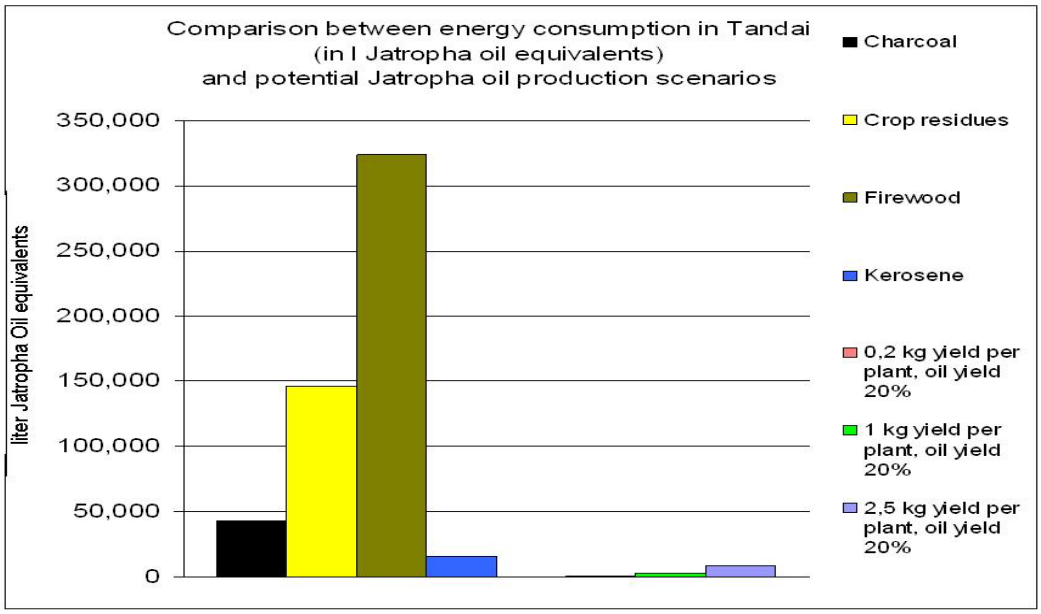
2.2.2 Session 2: "Value chains of biofuels production in Tanzania: Which aspects are important and realistic"

Dr. Uckert presented value chains of biofuels production in Tanzania whereby Tandai village was taken as a case study. He talked about energy consumption per household (in kg/l per week). Average household size was 6.3.



In Tanzania, total energy consumption is 768 PJ; with 42 million habitants, it means national average energy consumption is about 18.278 MJ per head. Average energy consumption per head in Tandai is 9.843 MJ per year.

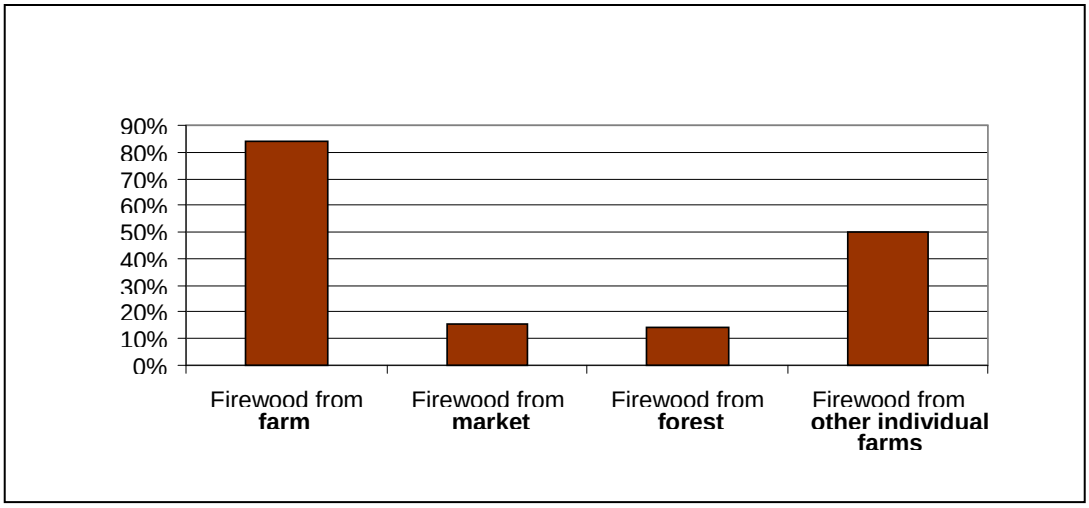
Analysing the data, he compared between energy consumption in Tandai and potential Jatropha oil production scenarios.



The speaker referred to the chart above to make the following observations:

- 252 kg of Jatropha seeds are needed to substitute the Kerosene consumption per household per year,
- There are 96 existing Jatropha trees per household,
- 156 additional Jatropha trees are needed for substitution of Kerosene consumption per household per year (approximately 1kg/plant).

He further presented the following chart to discuss firewood sources in Tandai.

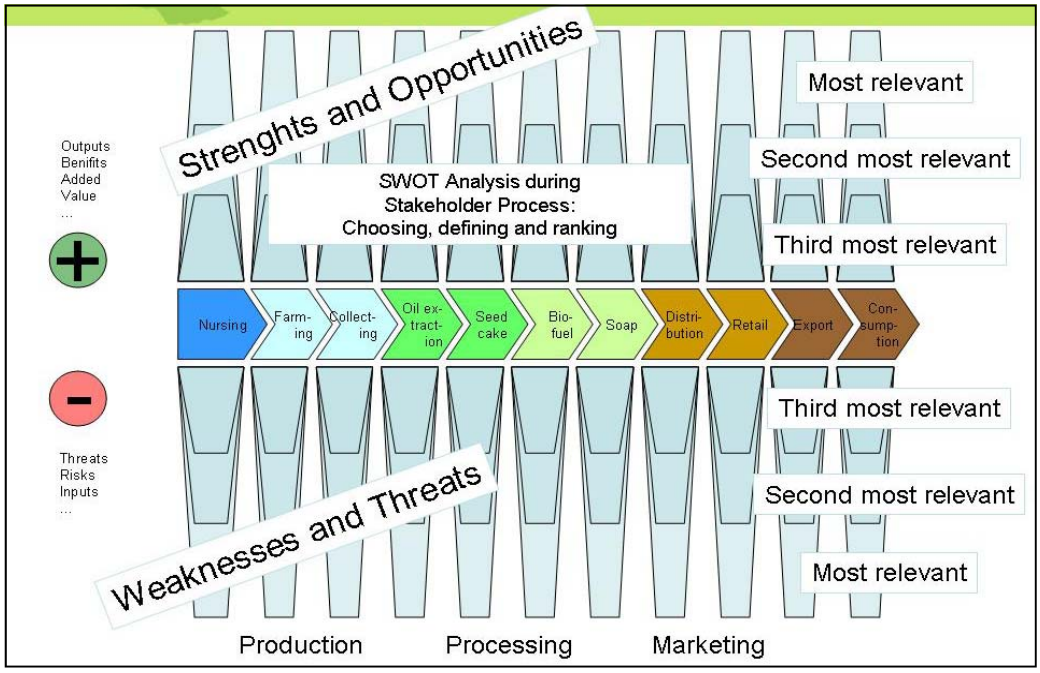


About 96 % of households agree that it is meaningful to protect forests completely, so no extraction should be allowed at all. In addition, a quarter of the villagers participate in activities of forest protection (tree planting), whereby the overall number of trees per household is 173. Average existing Jatropha trees per household is 52; and more than 31 new Jatropha trees are planted in average per household and year. Majority uses Jatropha as supporting tree fo spice production, only the minority uses it for medicine or seedlings. Main production system is intercropping; other purpose is hedging (mostly for fixing of borders).

Dr. Uckert described the on going data collection surveys across the country (Annex 4).

Before discussing the preliminary value chain analysis, Dr. Uckert gave a quick background on the challenges the bioenergy sub-sector faces; these are poor infrastructure / low market access, dominance of subsistence (small farmer livelihoods) and poor implemented new bio-energy sources. About 80% energy consumption is woody biomass mainly wood and charcoal. Dependence on wood biomass has environmental threats (over-usage of forest). Rural people are facing a number of challenges such as low rate of electrification (less than 2% in rural areas) and low level of agricultural production. Jatropha and Oil Palm have the potential to improve rural people livelihoods through provision of bio-energy and income/employment (potential for export and out -grower schemes).

Following this, he presented methods of value chain analysis using the following chart.



Also, the speaker talked about step-by-step procedures of participatory adjustment of Sustainability Impact Assessment (SIA) indicators. These are:

Step 1: Define value chains and specify factors in order of relevance. Factors that will be found could be subsumized under the three dimensions of sustainability. But:

- Crosscuttings are possible
- Accountability for balances / aggregations are difficult
- Often just assumptions or hypotheses are existing

Step 2: Relative weighting factors within specific value chain. Objective is to build up an indicator system to cope generic principles:

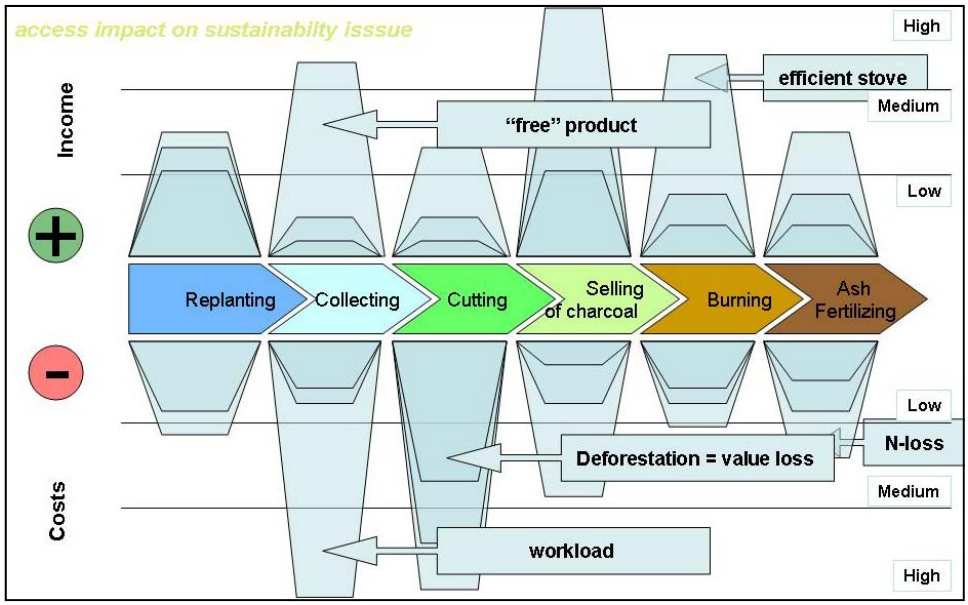
- Indicators should be mostly quantified or methodological derived.
- In the field of innovation also a strong role of so called „weak factors" like acceptance, risk tolerance, etc.)
- Transparency in the assessment process: definitions of ''high", ''medium" and ''low" for each factor

Step 3: Compare different value chains. Objective is to build up a comprehensive visualisation for decision support and fast identification of best practices between and within the different value chains:

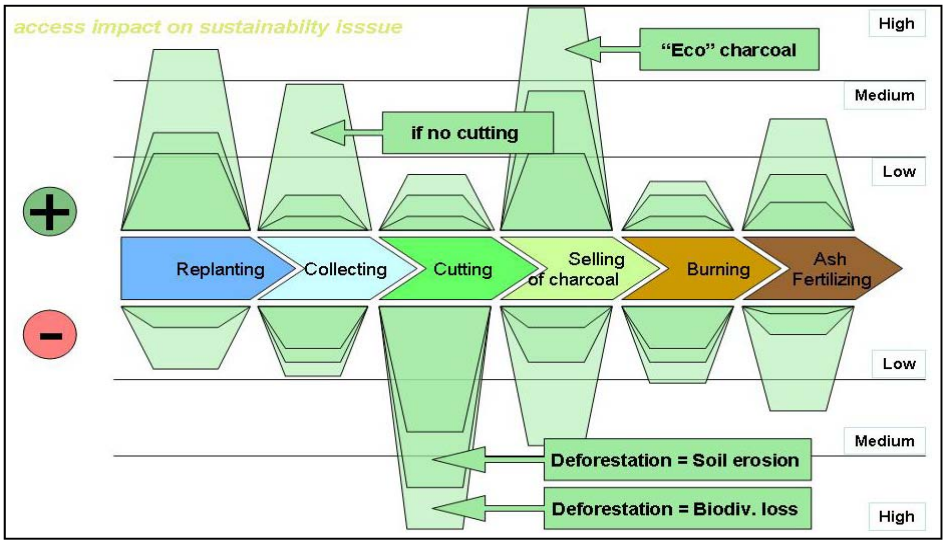
- Combination of aggregated sustainability issues in one image in order of their relevance
- Aggregation via assessment tool derived from principles
- (This tool is to be developed and adjusted for biofuels)

He then summarised value chain for wood in the context of economical, ecological and social aspects by giving potential examples:.

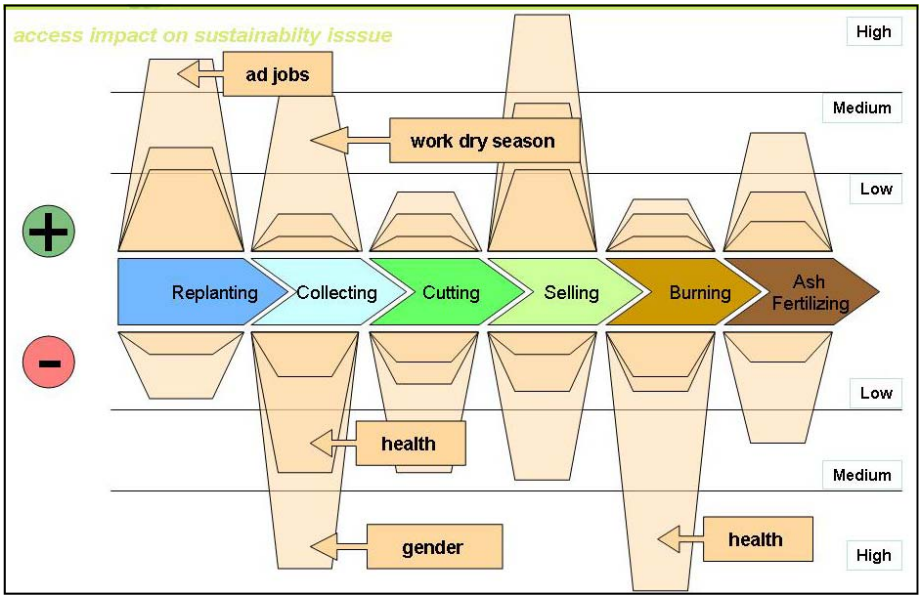
Wood value chain - economical



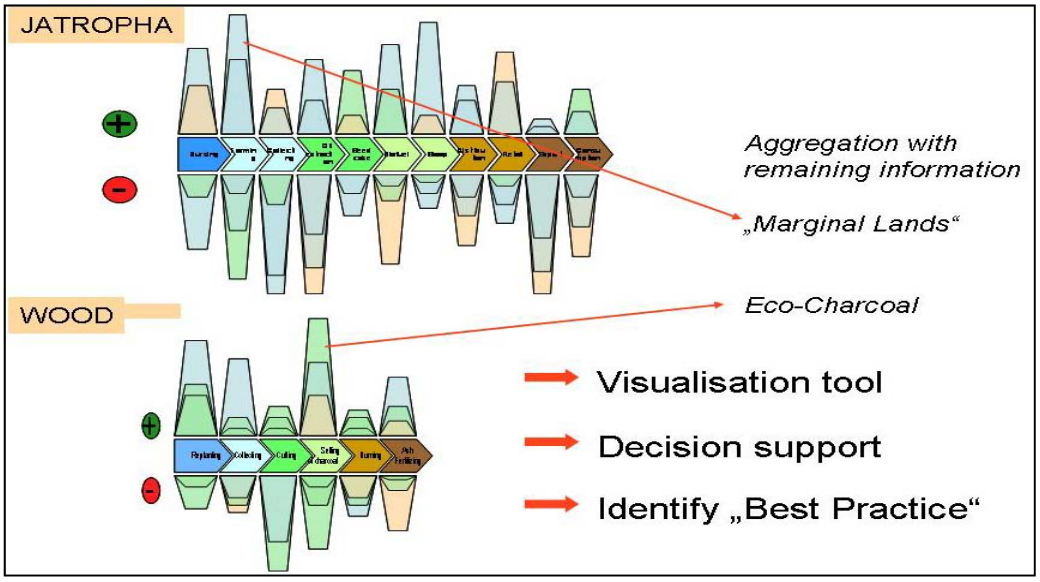
Wood value chain – ecological



Wood value chain – social



He further compared the value chains of Jatropha with wood.



Dt. Uckert illustrated steps, indicators and assessment in the value chain of woodfuels (firewood and charcoal) using the following table.

	Step 1		Step 2		Step 3		Step 4	
	Index	Area	Index	Production	Index	Processing	Index	Usage
Indicator 1		LUC (land use change)		trees per HH		degree of efficiency (whole chain)		energy demand kWh/HH
Indicator 2		iLUC (indirect land use change)		yield per ha		feasebility of technology		type of stove
Indicator 3								

2.2.2.1 Group work and presentations

Based on the presentation on value chains on biofuels production, participants were divided into three groups and asked to develop value chains for woodfuels (firewood and charcoal), Jatropha and palm oil.

Group presentations are as follows:

Group 1: Woodfuels (firewood and charcoal) value chain

Charcoal	**Firewood**
• Tree planting • Harvesting – tree species, sources, permits • Processing – cutting and chopping • Carbonization – kilns, loading, packaging • Transportation • Distribution and marketing – wholesalers, retailers • Consumption – consumers-cookstoves	• Tree planting • Harvesting – tree species, sources, permits • Processing – cutting and chopping • Transportation • Distribution and marketing – wholesalers, retailers • Consumption – consumers-cookstoves

Group 2: Jatropha value chain

Planting
- Need time/labour, employment
- Cost of production
- Depend on the amount of water in the soil
- Soil fertility to increase productivity

Crop management
- Water availability
- Soil impact
- Residues – soil organic matter

Harvesting
- Rain feed

Processing
- Drying structure
- Oil expeller

Marketing

Group 3: Palm Oil – FELISA Case Study

- Nursery establishment and management,
  - Takes about 12 months
- Planting/transplanting,
- Production/harvesting,
  - Can happen after 5 years,
  - High production from years 10-25
  - Yield – 4 tones/ha (without irrigation); 8 tones/ha (with irrigation)
  - Low oil content during dry season; high oil content during rain season
  - Three harvesting after every 4 months
- Processing,
  - Traditional system – 60 % of oil extracted
  - Efficient systems – 80-90% of oil extracted
- Storage
  - Decant the oil to remove water which was added during the processing (boiling and pressing)
  - Uses- palm cake for power generation (1 ha can give 1kWh), palm oil for food, kernel oil for soap making

2.2.3 Session 3: "Sustainability indicators for biofuels production"

Mr. Hoffmann made a presentation on sustainability indicators for biofuels production. He mentioned that theoretical potential of arable land for bio-energy production ranges between 30 and 55 million hectare. Civil society organizations have show strong resistance against land allocation for biofuels investors due to environmental and land grabbing issues: They are aiming sustainable production of biofuels.

He presented a table which shows selected bio-energy companies operating in Tanzania

	Jatropha	Sugarcane	Oil palm	Castor
Outgrower schemes*:				
1) DILIGENT (Netherlands)	X			
Large scale monocultural operations:				
2) SUN Biofuels (UK)	X			(X)
Mixture (nucleus plantage & outgrower schemes):				
3) EcoEnergy (Sweden)		X		
4) FELISA (Tanzania)	X		X	
5) PROKON (Germany)	X			

He further presented a raw version of sustainability indicators for the case study village (Tandai). Indicators were developed in cooperation with local, regional and national experts first Better-iS workshop held in Morogoro in February 2010; and village leaders and early adopters in Tandai village.

Indicators proposed during the workshop were discussed with Tandai villagers and ranked as shown in Annex 5.

Adjustment of these indicators in accordance with collected data is ongoing. Indicators are incorporated into a second data collection period in the outgrower villages of Prokon (Mpanda), Felisa (Kigoma) as well as in the village of Laela where TaTEDO based an MFP. The set of indicators will be used to verify the sustainability of different steps in the value chains of Woodfuels, Jatropha and Palm oil.

2.2.3.1 Group work and Presentations

Based on the presentation on sustainability indicators for biofuels production and previous group presentations on the value chain, participants were grouped in three groups and asked to allocate the appropriate indicators to the respective steps in the value chains.

Group presentations are summarized below.

Group 1: Woodfuels chain

	Economic indicators	**Socio indicators**	**Ecological indicators**
Tree planting	▪ Number of newly planted trees per year per household	▪ Livelihood – income/employment ▪ Socio status – importance of trees and recognition ▪ Time saving in hours ▪ Socio interactions – good/bad ▪ Health – illness cases	▪ Soil fertility – increased productivity ▪ Land use/cover/landscape ▪ Water quality – quantity/quality ▪ Biodiversity – number of species ▪ Micro climate ▪ Air quality
Harvesting	▪ Distance to wood sources ▪ Yield per ha per year	- do -	▪ Soil fertility – productivity ▪ Land use/cover/landscape ▪ Water quality – quantity/quality ▪ Biodiversity – number of species ▪ Micro climate
Processing	▪ Cost per output	- do -	▪ Soil fertility – increased productivity ▪ Land use/cover/landscape ▪ Water quality – quantity/quality ▪ Biodiversity – number of species ▪ Micro climate ▪ Air quality
Carbonization	▪ Cost per output ▪ Adoption of efficient kilns	- do -	▪ Air quality
Transportation	▪ Cost per kg per km	- do -	▪ Air quality
Distribution/marketing			
Consumption	▪ Cost per output	- do -	▪ Air quality
	▪ Adoption of efficient cookstoves		

Group 2: Jatropha chain

	Economic indicators	**Socio indicators**	**Ecological indicators**
Planting	▪ Number of newly planted Jatropha trees per household ▪ Cost of production of Jatropha seeds ▪ Number of existing Jatropha trees per household	▪ Employment ▪ Number of women involved ▪ Importance of Jatropha as place for community meetings ▪ Social interactions ▪ Labour savings ▪ Accident reduction – small scale	▪ Soil fertility ▪ Land use/cover/landscape ▪ Water (quality and quantity) ▪ Biodiversity
Crop Management			▪ Soil fertility – productivity ▪ Land use/cover/landscape ▪ Water quality – quantity/quality
Harvesting	▪ Household income	▪ Number of women involved	
Processing	▪ Adoption of Jatropha processing devices ▪ Household income		▪ Weather and climate
Marketing	▪ Adoption of efficient cookstoves	▪ Health (medical purpose) ▪ Adoption of Jatropha devices (cookstoves, lighting, etc)	

Group 2: Palm Oil chain - Indicators

	Indicators
Nursery establishment/management	**Ecological indicators** ▪ Landscape ▪ Air quality ▪ Land cover **Social indicators** ▪ Social conflicts ▪ Social interactions ▪ Health ▪ Importance of palm tree ▪ Habits of palm tree usage **Economic indicators** ▪ Household income ▪ Cost of production for palm oil ▪ Number newly planted palm trees ▪ Number of existing palm trees.
Planting/transplanting	
Production/harvesting	
Processing	
Storage	

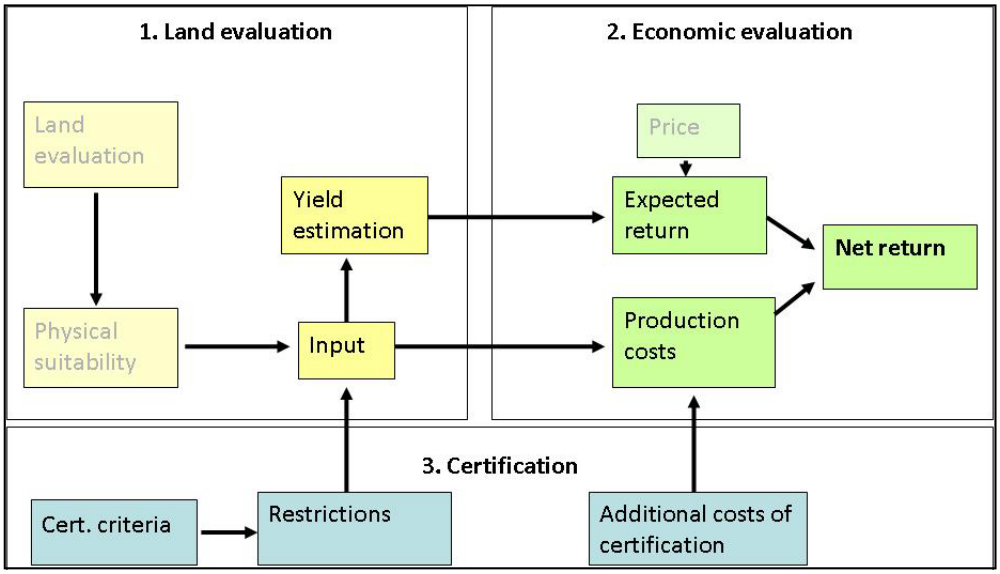
2.2.4 Presentation

2.2.4.1 Economic land evaluation

Ms. Anna Segerstedt, a PhD student from the Institute for Environmental Economics and World Trade, Leibniz University of Hannover, Germany was invited to present results on economic land evaluation. She pointed out that large scale biofuels production in Tanzania has potential for domestic consumption, export and certification. Furthermore, she linked large scale biofuels production with research questions related to economic land evaluation issues. Questions were:

- Is Tanzanian Jatropha cultivation feasible and sustainable?
- Does it have potential for export?
- What impact would certification criteria have on production and costs?

She presented a chart to show steps in each research area.



The presenter highlighted that data estimation in each research areas were obtained from secondary literature, an experimental farm[1] (in Kilosa District) and characterized by monoculture system and low level mechanization.

In the following, she then presented tables, graphs and charts to show land evaluation results:

[1] It was a **sisal farm, took up Jatropha production in 2007**

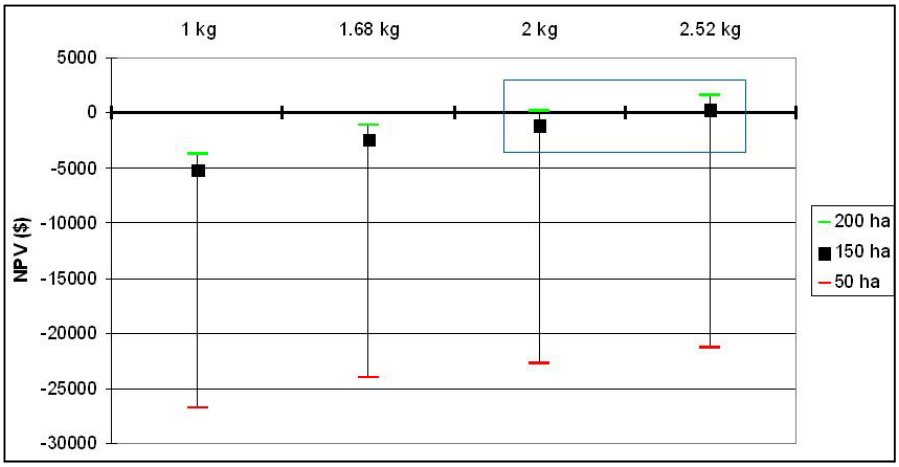
Overall good land suitability

	Land suitability
Soil texture	S2
pH	S1
Soil organic matter	S1
Available soil phosphate	S2
Cation exchange capacity	S1
Base saturation	S1
Slope	S1
Temperature	S1
Rain	S2
Length of growth period	S2
Overall rating	**S1/S2**

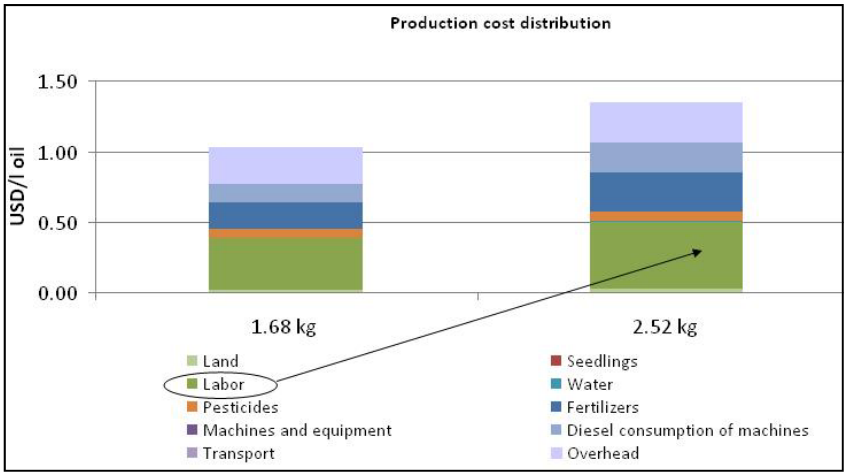
Land suitability classification for a luvisol at the study site. S1=highly suitable, S2=moderately suitable, S3=marginally suitable, N1=currently not suitable, N2=permanently not suitable. *FAO (1976) and Landon (1991)*

She used the following graphs and charts to revel economic evaluation results

Net Present Value (NPV) and Scale of Production



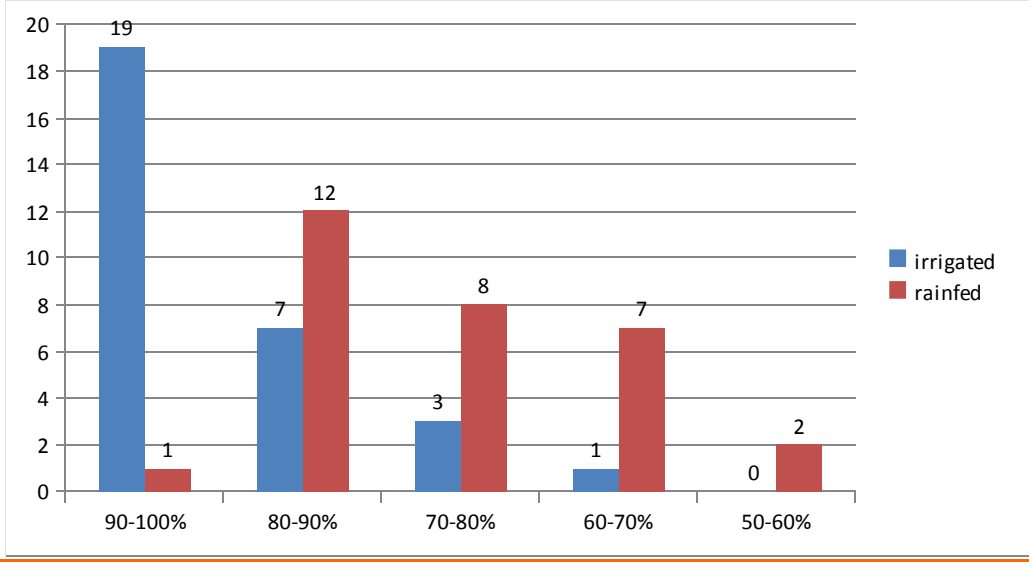
Cost Distribution - Contribution of different factors to production costs. Real discount rate of 7.54 percent



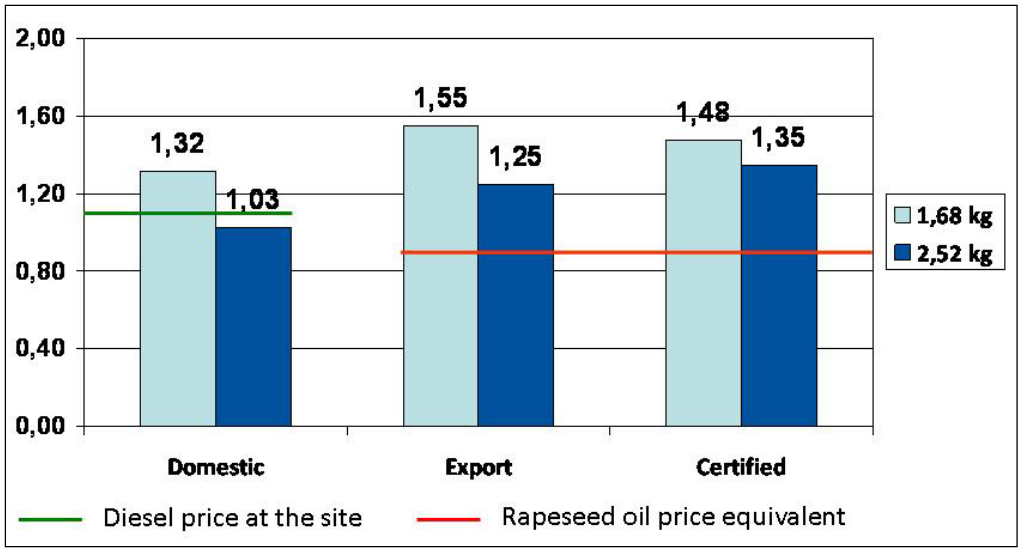
Under the aspect of certification, Ms. Segerstedt elaborated on the increased cost due to additional labor activities. It is estimated that total cost increase will be approximately 9 percent.

Focus	Additional activities
Soil and water protection	If good soil quality, little erosion ⇒Sustainable also on high input level
Pesticide and fertilizer management	Storage, calibration, IPM
Water use	Water rights, drought exposure ⇒ Water impact assessment
Biodiversity and GHG	No land use change, GHG savings>35%
Social	No forced labor, no child labor, compliance with official working hours, wages ⇒Risk assessment, trainings, additional benefits
Other	EIA, waste and pollution management
Certification fees	Certification process, additional labor
Total cost increase	↑9%

Additionally, she explained the important factor of water consumption (irrigation vs. rainfed production) in detail and cited simulation of yield level field site (1971-2000) whereby under the rainfed, most observations only reach 60-90% of full yield potential with increasing an average of 15% loss of yields. This would lower revenues by 15% in high-yield scenario.



Finally, she summarized as discussed aspects to evaluate the economic viability of Jatropha production. She presented the following graph to show production costs of one liter Jatropha oil (in US$) for 150 ha (at real discount rate of 7.54%).



Summarizing all discussed topics, she concluded that:

- High input level required,
- Certification: Compliance with sustainability criteria not the problem but high production costs in general,
- With current diesel and vegetable oil prices, production better suited for domestic consumption than export,
- Research (cultivation, mechanization) crucial for future development.

In line with the summary, she provided an outlook of outgrower schemes in Tandai village, which is characterized by low land suitability, no agro-chemical input and no irrigation. Farmers in Kinole should expect low yields. On the other hand there is low opportunity cost of labor; it can supplement to value chains of vanilla and pepper.

2.2.4.2 Question and Answers

Question: Due to the geographical location of Tandai, fertilizer application is important but now most of the villagers want to practice organic farming to cater for international markets. What is your advice?

Answer: Organic farming allows use of certain types of manure and pesticides.

2.2.5 Session 4: "Maximizing Efficiency in biomass use: which strategies work for Tanzania"

Ms. Katrin Bienge, a Research Fellow at Wuppertal Institute for Climate, Environment and Energy presented their approach to explore strategies to maximize efficiency in biomass use in Tanzania.

She started by discussing preliminary research results on forest resources and woody biomass. Over 90 percent of all energy consumed in Tanzania is derived from biomass, mainly for domestic energy. Around 90 – 97 percent of a national wood production is used as woodfuels (firewood and charcoal). Consumption of firewood and charcoal, expansion of agricultural land and illegal logging are likely to be main drivers of deforestation in Tanzania which is at the rate of 300,000 – 500,000 ha/year.

Some estimates of woodfuels consumption vs. production.

Resource	Annual consumption	Annual allowable utilization	Source
All wood products	50 mio m^3	67 mio m^3	Kaale 2005
Wood fuels	36 mio m^3	24 mio m^3	Lusambo 2009

It is obvious that firewood and charcoal production and consumption will increase., as, according to the UN Population Division, population is projected to grow from 45 million (2010) to 59.6 million (2020) and 109.5 million (2050). This implies more demand for woodfuels; hence, considerable increase in demand for forest resources. On the other hand, fossil fuel prices are projected to increase. High fossil energy

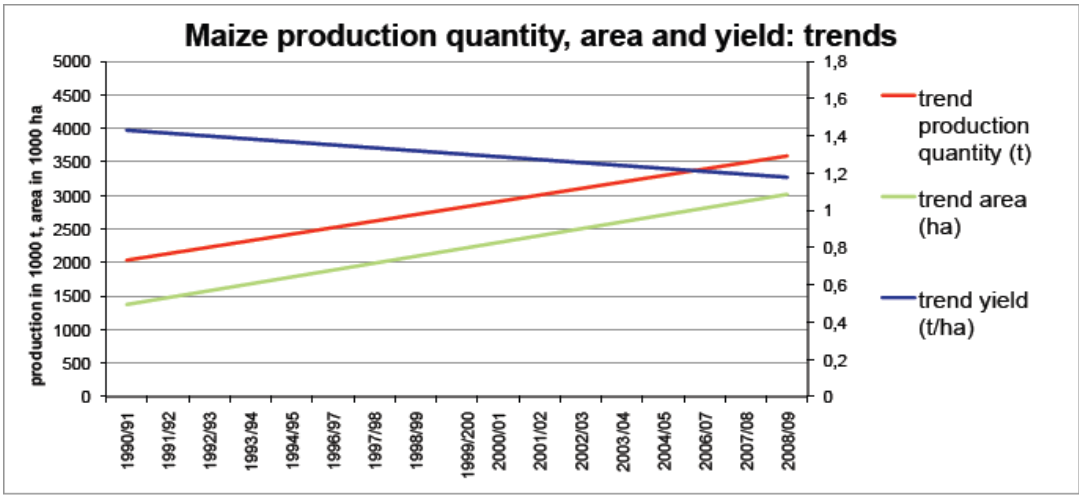
prices might increase shifting to woodfuels and put tremendous pressure on forest resources.

She added that uneven distribution of forest resources has resulted in wood scarcity in some parts of the country.

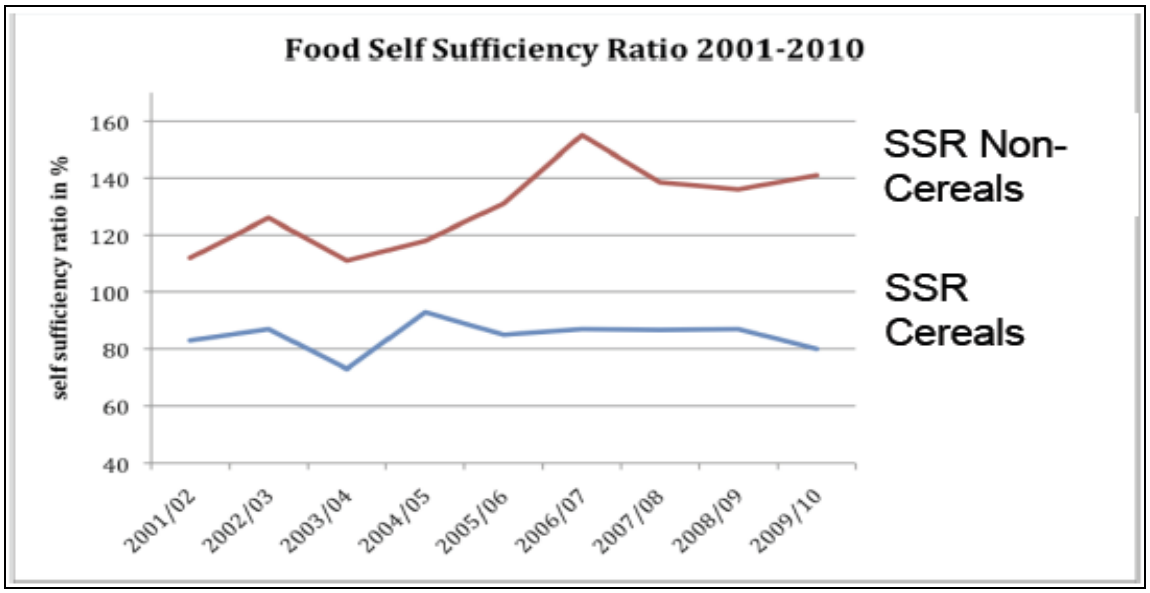
Region	Total forest land (ha)	Population 2002 (1000)	Forest area ha/person	Biofuel scarcity ranking
Dar es Salaam	2,607	2,497	0.00	Severe
Kigoma	1,706,000	1,679	1.02	Not reported
Iringa	826,831	1,495	0.55	Moderate

Firewood is collected and consumed mostly in the rural areas. Charcoal is produced in rural areas but mostly consumed in urban and pre-urban areas therefore became a marketable resource with an economic value chain as well as an important source of income. It is estimated that Dar es Salaam alone consumes between 30 – 50 percent of the total national charcoal consumption.

Additionally, Mrs. Kennedy, a researcher from Wuppertal Institute, talked about agricultural biomass. Agricultural production and areas used for agriculture are increasing, buy yields are stagnant and remain low. Possible reasons are degraded soils, very low level of inputs (e.g. irrigation, fertilizer, and machinery), inefficient cultivation, etc. Different crops show different trends. For example, maize, cassava and rice are slightly decreasing; potatoes, pulses are slightly rising; and sorghum is stagnant.



Self-sufficiency describes the difference of production and demand. If it is less than 100 percent that means there is deficit; and there is surplus if it is more than 100 percent.



From the graph – no self-sufficiency for cereals therefore imports needed.

About 85 percent of the agricultural land in Tanzania is used by small holder farmers. The level of official land title ownership among small holders is very low and in many regions, land access is a problem. In 2003, 46 percent of small holder households in different regions reported insufficiency of land.

Region	% of households reporting insufficient land
Arusha	77 %
Morogoro	43 %
Ruvuma	24 %

Many households are unable to produce a surplus to sell due to limited land availability, low yields, etc.

Population growth generally means more people to feed. Without rising yields, this will result in a higher demand for land suitable for food production or in an increase of food imports. Land scarcity of smallholders and competition with other land uses could threaten food security in many parts of the country. Also, there is threat of rising food prices and increased poverty. Increased pressure on land for agricultural production will likely lead to conversion of forests to farmland and accelerate deforestation.

Mrs. Kennedy also discussed the energy situation in Tanzania and pointed out that the choice of energy source depends on many factors such as location of household (which determines access to different types of fuels), income, education level, residence ownership and dwelling category.

Only 10 percent of the population has access to grid electricity, with the rural electrification rate being only 2 percent. More than 72 percent of households are fuel poor; they spend over 10 percent (sometimes up to 80 percent) of their income on energy. While the national energy demand is increasing rapidly, the government spends about 24 percent of total import expenditure on fossil fuel products.

Generally, there is a potential for biofuel production in Tanzania. Suitable crops include Jatropha, palm oil, sugarcane but also agricultural residues and animal dung are potential sources of energy. Biofuels could substitute costly oil imports and could become a potentially sustainable and low cost energy source. Additionally, they hold the potential to foster agricultural income and economic growth in rural areas. The potential to use plant oil or biogas from agricultural wastes for local decentralized energy applications might also be a solution for rural communities.

Biofuels possible threats are:

- Competition for fertile land, water and labour with food crops and other uses,
- Negative impacts on price and availability of food crops through land competition, direct competition with other uses (e.g. palm oil for food purposes),
- Land grabbing leading to loss of access to and rights over customary land of local communities,
- Poor availability of some biofuels crops can pose an economic threat to smallholders and limit competitiveness with fossil fuels (especially Jatropha),
- Potential agronomic and ecological threats: Land of specific studies and experience on influence of different biofuels crops on soil and environment (especially Jatropha),
- Water scarcity (if irrigated), deforestation and biodiversity loss.

2.2.5.1 Group work and presentations

Participants were asked the following questions on forest resources:

- Are there further important national trends on forest resources?
- Which regions are most affected, reasons for regional variations?
- Which strategy is most promising, which other options exist now and in the near future?

Each participant noted answers on the cards as summarized below.

National forest trends

- If ongoing REDD initiatives will bring some impacts, deforestation rates will decrease,
- Approximately 41 percent of total deforestation in Tanzania is attributable to household woodfuels consumption,

- Researches are required to understand energy balances,(planting vs. harvesting),
- Forests are being depleted which will result in many socio-economic and environmental problems,
- Increased number of livestock and bad agricultural practices contribute to forest diminishing within the area,
- The demand for energy is increasing very rapidly; firewood and charcoal are the major sources of cooking energy. There is an increased deforestation due to lack of alternative energy.
- Deforestation will further increase because of population, villagalisation to urbanisation, climate change and poverty
- Low enforcement of legal instrument for environment conservation has contributed to deforestation,
- It is estimated that about 900.000 ha of forest are destroyed every year

Most affected regions

Semi-arid regions with fragile ecosystems as e.g. central Tanzania are mainly affected because most of these areas have depleted their forest resources. A special challenge for research is the non-existence of data on forest losses. Higher regional variations are expected because of different climate change mitigation measures.

- **Kilimanjaro and Manyara**: Many people use trees for energy purposes and pastoralism, high population density,
- **Dar es Salaam, Kigoma, Rukwa**: People migrate to the city, they all need to cook and eat so energy demand is increasing; Kigoma and Rukwa: These are among the food producing regions and affected by an increasing number of refugees camps, whose inhabitans cut down trees / forests to get fuel for cooking and cultivation
- **Shinyanga, Dodoma, Singida, Arusha**: Those are most affected because of climatic conditions (drought); big number of livestock and high population pressure on forest resources,
- **Mwanza**,: Mainly affected due to regularly occurring droughts
- **Mbeya**: Long history of woodfuel consuming tea curing industries ,
- **Coast region**: Mainly because of high demand of woodfuels in Dar es Salaam and uncomplicated transportation
- **Morogoro**: Potentially most affected because located close to Dar es Salaam, which is the most prominent market for charcoal

Strategies

- Effective implementation of relevant policies and strategies. National forestry policy should be translated to the rural people
- Enforcement of laws and legal instrument at all levels,
- Participatory forestry management should be strengthened and widely promoted,
- Operationalization of the forest services agency,

- Promoting village plantations and community forests coupled with awareness and education programmes,
- Formalization of the charcoal sector,
- Support village land use planning exercises,
- Provide sufficient financial resources to forest officers at all levels,
- Proliferation of energy conserving stoves in all regions,

3.0 Conclusion

The workshop organizers were highly satisfied with the content and participation during the workshop days. Though no formal evaluation of the workshop was conducted, the thoughtful debates, especially during the panel debate, indicate that the event was worthwhile and successful.

The individual sessions provided a comprehensive framework for sustainable biofuels production in Tanzania. Additionally, the participants have been updated on the results from the research conducted under the Better – iS project; implications of biofuels on environment and socio-economic aspects, and sustainability indicators were well covered by the research.

As milestone for the project, the gathered findings will be implemented into further research approaches especially into the upcoming surveys in Mpanda and Kigoma (in Prokon and Felisa outgrower villages).

Annexes

Annex 1: Workshop programme

Day 1: 7th December 2010

09:00 – 11:00	Registration, coffee and networking	Dr. Kitalyi, Dr. Uckert, Mr. Emil
11:00 – 11:20	Welcome address	Dr. Kitalyi and Dr. Sieber (on behalf of the Better-iS team)
11:20 – 12:00	Presentation of the consortium, the partners, first project results and the support tool	Better-iS research team
12:15 – 13:00	Key note speaker	MEM Representative
13:00 – 14:00	Lunch Break	**Participants**
14:00 – 16:30	Panel Discussion: Biofuels development in Africa: where is the small-scale farmer?	Moderator: Prof. George Jambiya Panelists: 1. Ester Mfugale – MEM 2. Dr. Damas - SUA 3. Emilian Nyanda - JPTL 4. Dr. Hongo - FELISA 5. Bariki Kaale - UNDP 6. E. Sawe- TaTEDO
16:30 – 16:45	Tea break	**Participants**
16:45 – 18:00	Working groups: Part 1 Biofuels and Development – Complementing each other?	Workshop Facilitator
18:00 – 18:30	Summary of working groups	Workshop facilitator

Day 2: 8th December 2010

8:30 - 9.00	Summary of day one and introduction into the Workshop topics of day two	Workshop Facilitator
09:00 – 10:15	Key note and Introduction of the Better-iS project	Dr. Stefan Sieber
10.15 – 10.45	Biofuels Development in Tanzania	**Ester Mfugale – Ministry of Energy and Minerals**
10:45 – 11:00	Tea break	**Participants**
11:00 – 13:00	Working groups: Session 2 Value chains of biofuel production in Tanzania: Which aspects are important and realistic (Wood, Palm oil, Jatropha sub-groups) and Session 3 Sustainability indicators for biofuel production including 1) definition of NEW key parameters, 2) Specification and operationalisation of OLD sustainability indicators developed in the first meeting at SUA, (3) Ranking of indicators – also possible as ranking exercise in form of a questionnaire with the complete audience	Workshop Facilitator
13:00 – 14:00	Lunch break	**Participants**
14:00 – 14:45	Summary of Working groups Part 2 and 3	Workshop facilitator
14:45 – 15:40	Working group part 4 Maximizing efficiency in biomass use: Which strategies work for Tanzania	Katharina Kennedy and Katrin Bienge
15:40 – 16:30	Discussion of way forward and workshop evaluation	Dr. Kitalyi / Dr. Uckert

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Annex 3. Participants Expectations.

(i) Knowledge and education

- Knowledge on how biofuels can contribute to pro-poor development,
- Knowledge expansion on issues related to biofuels,
- Learn more on biofuels development in Tanzania,
- Community education on modern environment conservation techniques especially in the Uluguru mountains,
- To know the extent of cultivation of biofuels especially Jatropha in Tanzania and Africa and if there is any effects to the environment,
- Are biofuels from food/energy crops a sustainable option for small scale farmer,
- To know other crops which can suite for biofuels production apart from Jatropha,
- To get the most practical experience that can be scaled up and replicated in the wider perspective in Tanzania.

(ii) Community participation and livelihood

- How the communities best motivated to engage themselves in promoting biofuels,
- How the small scale farmer could benefit,
- How best small scale farmer can be involved and benefit from biofuels farming,
- Impacts of biofuels on food security,
- Best field lessons on biofuels with tangible benefits to the society
- Ways of making sure that sustainability on biofuels production is maintained at the local level.

(iii) Research

- Knowledge transfer based on the action-based researches such as Better-iS project - feedback to our studies
- To evaluate our research results and knowledge expansion,
- Viability of biofuels production – cost and benefit analysis

(iv) Policies and strategies

- Come up with recommendations for effective biofuels development policy in Tanzania,
- Active support from the policy makers to the biofuels growers,
- Road map for sustainable biofuels development in Tanzania,
- Proposed strategies for production system where small scale farmers are taken onboard.

Annex 4: Data collection surveys across the country

- **Multi-functional Platform (MFP) and prospected value chain of SVOs (Straight Vegetable Oils).** Master Thesis of Jan Rordorf: Socioeconomic analysis
- **Other Master theses**

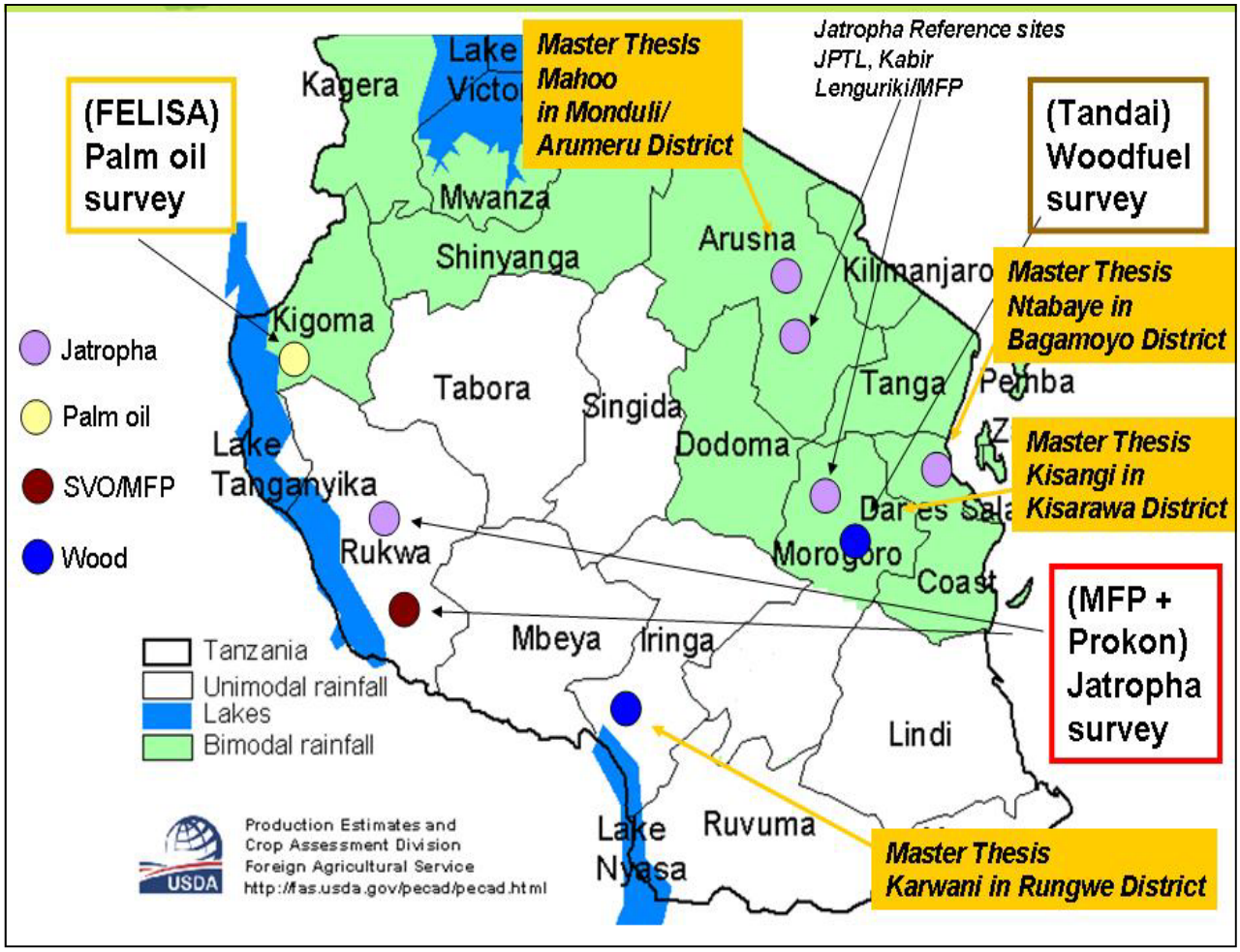
  Topic 1: Impact of Jatropha on water supply
  Title: To assess the possible influence of selected *jatropha carcus* cultivation on water supply in Bagamoyo district.
  Name of the student: Ntabaye, Prisca Patrick
  Start/End: December 2009 to September 2011
  Expected data delivery: January 2011 – Dissertation and publication
  Responsible Institution/Co-Institution: Sokoine University of agriculture (SUA)
  Supervisors: Prof. P.T.K. MUNISHI (Department of Forest Biology), Dr. L.LUSAMBO (Department of Forest Economics) (IFPRI Siwa Msangi)

  Topic 2: Biofuel investments and development
  Title: Potentials, challenges and opportunities for biofuel development in Tanzania: a case study of Kisarawe district in Tananzania.
  Name of the student: KISANGI THADEUS B.
  Start/End: December 2009 to September 2011
  Expected data delivery: Dissertation and publication
  Responsible Institution/Co-Institution: Sokoine University of agriculture (SUA)
  Supervisors: Prof. E. Luoga and Dr. Kashaigili J. (Department of Forest Mensuration)

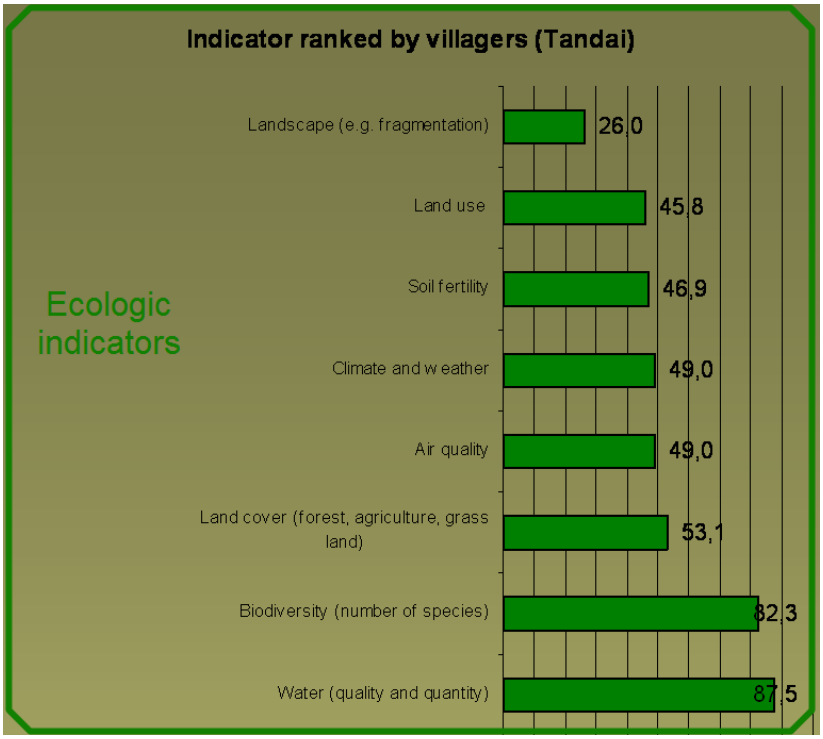
  Topic 3: Woodfuel Value Chains
  Title: Short rotation coppices agroforestry: potentials for bioenergy and livelihoods improvement in Rungwe district Tanzania
  Name of the student: KARWANI GEORGE
  Start/End: December 2009 to September 2011
  Expected data delivery: Dissertation and publication
  Responsible Institution/Co-Institution: Sokoine University of agriculture (SUA)
  Supervisors: Prof. LULANDALA L.L.L (ICRAF Dr. Aichi Kitalyi)
  Project: Better-iS
  Topic: Marketing

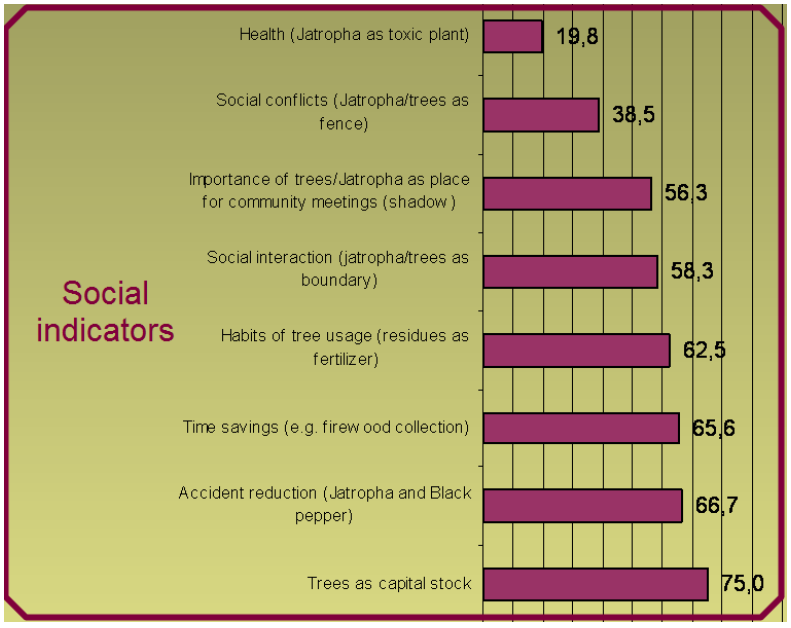
  Topic 4: Jatropha opportunities on Value Adding
  Title: Marketing efficiency analysis of the existing jatropha value chain in northern Tanzania; case study of Monduli and Arumeru districts
  Name of student: MAHOO, PENDO-EDNA

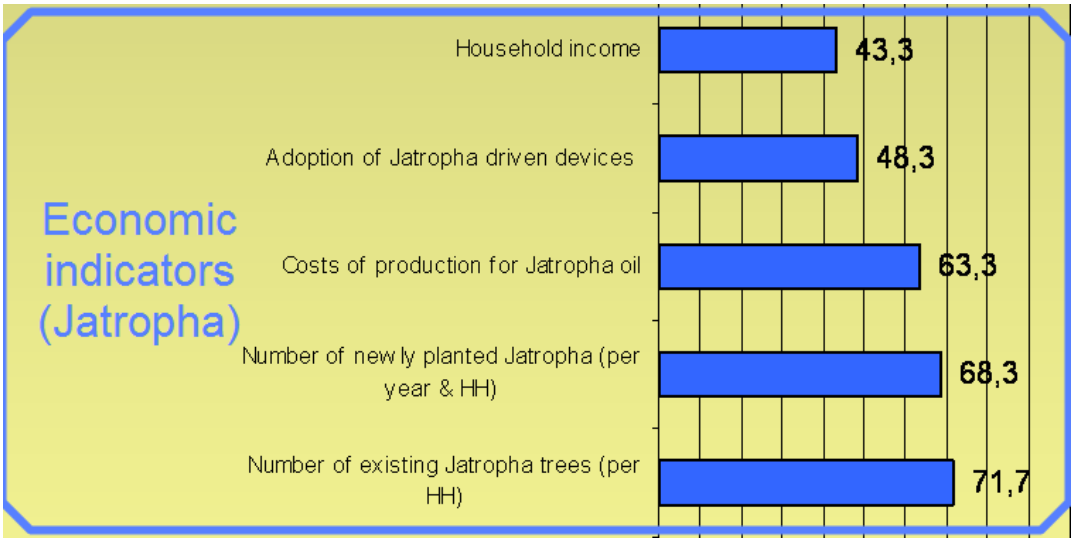
Start/End: February 2010 to September 2011
Expected data delivery: Dissertation and publication
Responsible Institution/Co-Institution: Sokoine University of agriculture (SUA)
Name of supervisor: DR. KHALMADIN MUTABAZI (Department of Agricultural Economics)

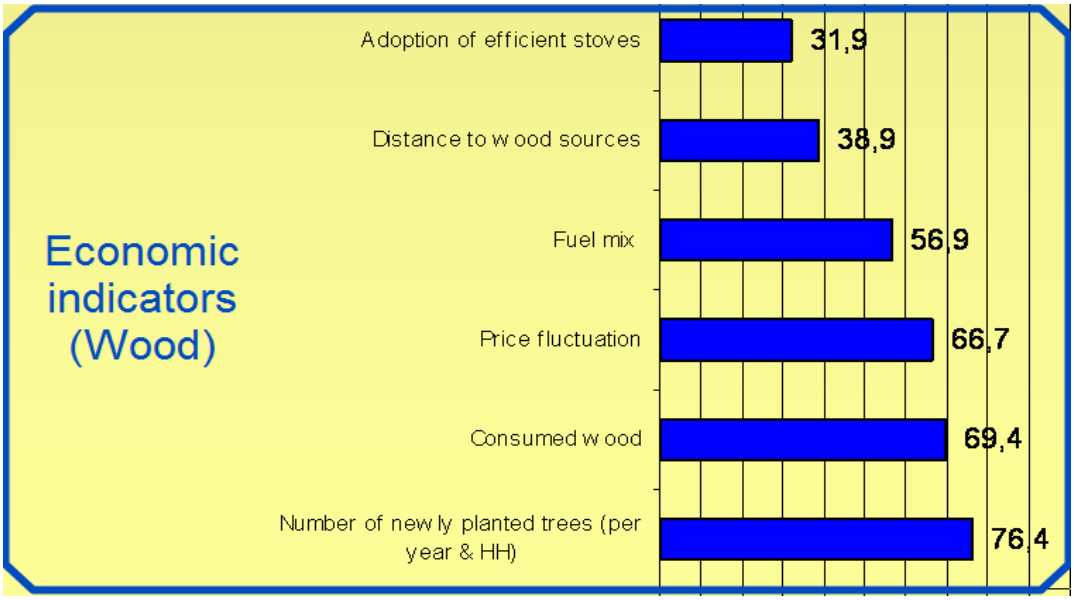


Annex 5: Indicators as ranked by Tandai Villagers






Economic indicators (Jatropha)
Household income
43,3
Adoption of Jatropha driven devices
48,3
Costs of production for Jatropha oil
63,3
Number of newly planted Jatropha (per year & HH)
68,3
Number of existing Jatropha trees (per HH)
71,7


Economic indicators (Wood)
Adoption of efficient stoves
31,9
Distance to wood sources
38,9
Fuel mix
56,9
Price fluctuation
66,7
Consumed wood
69,4
Number of newly planted trees (per year & HH)
76,4